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American Veterinary Medical Association

FORMERLY AMERICAN VETERINARY REVIEW

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DIRECTORY DISTRIBUTED

During the past month the new edition of the A. V. M. A. Membership Directory was distributed to our members. As previously announced, this edition of the directory contains one innovation—the inclusion of information indicating the college (or colleges) of graduation and the year (or years) for each member. The compilation of this information proved to be no small undertaking.

In the first place, it was necessary to work out a standard system of abbreviations for the numerous veterinary colleges, both at home and abroad, graduates of which are members of the A. V. M. A. The similarity of names of some of these institutions presented difficulties of one kind or another. Quite a few errors were found in the original entries on our membership ledgers for some of our old members. We believe that all of these errors have now been corrected, but if any have crept into the directory it is because our records are inaccurate. It will be appreciated if members will direct to our attention any errors that are found.

Previous comment has been made on what would appear to be an unusually large number of changes of address reported during recent months. All changes reported up to March 5

were made before the directory went to press. This delayed publication somewhat, but the value of the directory is measured by its accuracy and every effort was put forth to have the new edition as complete and accurate as possible. As a further indication of the frequency of changes of address among veterinarians, it is merely necessary to point out that sixty-six changes have been reported since the directory went to press.

A few figures may be interesting. The directory contains the names and addresses of 4581 active and honorary members and veterinarians who have applications for membership pending. These members are found to be distributed in every state in the Union; in every province in Canada; most of the U. S. possessions; Cuba, Mexico, Honduras and four South American countries; several of the British West Indies; ten European countries; China and Japan; Egypt, South Africa and New Zealand.

The geographical arrangement (states, provinces and foreign countries) has been retained in the new edition of the directory. This plan has more advantages than the straight alphabetical arrangement thoughout, regardless of location, although, as previously pointed out, the ideal arrangement would be to have both the geographical and alphabetical lists incorporated in the director. This plan, however, would almost double the expense of publication and, for that reason, is out of the question at the present time.

The geographical listing conceals a few interesting facts in connection with the frequency of some of the common names. Examination of our membership ledgers shows that the Smiths, as usual, outnumber the members of any other name. There are just exactly forty Smiths on the roll at the present time. Second place goes to the Millers, thirty of whom are to be found on our roll. The Joneses, twenty-seven in number, have to be content with third place. Then come the Johnsons, to the number of twenty-three, closely followed by the Browns with twenty-one. Then come the Moores and the Andersons tied with nineteen apiece. Then we find seventeen members by the name of Martin and fifteen each of the Campbell, Clark, White and Wilson families. There are fourteen by the name of Williams and thirteen of the Davis clan, as well as thirteen Youngs. There are just a dozen Grahams and a dozen Thompsons.

EXECUTIVE BOARD ELECTIONS

The primary elections in Executive Board districts 1 (Canada) and 9 (New York and the New England States) are proceeding quietly, in fact, more quietly than is usually the case in these elections. Many members habitually fail to vote in the primaries, probably for the reason that the ballots do not contain the names of any candidates. It is this feature of our system of holding these elections that makes them really democratic. Any member can vote for anybody he desires to favor with his ballot. In the election proper, however, he is limited to the candidates whose names appear on the ballot, as determined by the result of the primary election.

The polls for the primary will be closed on April 23. As soon as possible after that date, the ballots for the election proper will be mailed to all paid-up members in the two districts. The polls will remain open for sixty days. As we have said before—here is a chance to stay at home and vote—by mail.

LIABILITY INSURANCE

Veterinarians will be interested in a few facts concerning liability insurance and damage suits against members of the profession. Liability insurance for members of the A. V. M. A. has been available for six years. During this time some 220 veterinarians have availed themselves of the advantages afforded by this particular form of insurance.

During the six years that veterinarians have enjoyed this protection, there have been fifty-six occasions when the insured found it necessary to call upon the U. S. Fidelity and Guaranty Company to defend them. This means that, on the average one veterinarian out of every four having this insurance has found it necessary to defend himself against some action started against him. Nine of these cases went to trial and in two instances verdicts were returned against the defendants. A number of cases were settled out of court. The amount of damages claimed or sued for has been quite large in some instances. During the year 1931, fourteen claims against veterinarians were handled in connection with this insurance.

It is not our intention to frighten veterinarians unnecessarily, but the figures given in the foregoing paragraph speak for themselves. The number of members who have found it necessary to fall back upon their liability insurance for protection against

actions started against them is larger than anyone expected when this form of insurance policy was first written. The quality of the protection given under this form of insurance is attested by the fact that in only two cases, up to the present time, have verdicts been returned against insured veterinarians. Of course, it is true that no small number of the actions started were based on insufficient grounds but, nevertheless, every case, no matter how poorly supported, caused more or less annoyance and uneasiness to the veterinarian involved. Considering that the insurance costs less than five cents a day, it would appear to be a rather cheap form of protection.

DOCTOR MARSHALL ON PERMANENT COMMISSION

A communication has been received from the officers of the Permanent Commission of the International Veterinary Congress, announcing the appointment of Dr. C. J. Marshall, of the University of Pennsylvania Veterinary School, to fill the vacancy on the Permanent Commission caused by the death of Dr. H. E. Bemis, about a year ago. Drs. John R. Mohler and Adolph Eichhorn are the other members of the Permanent Commission representing the United States.

MORE LIGHT ON ANAPLASMOSIS

Investigations conducted by Rees[1] at the U. S. Bureau of Animal Industry Experiment Station, at Jeanerette, Louisiana, show that bovine anaplasmosis may be transmitted by a second tick, *Dermacentor variabilis*. Previous work by the same investigator[2] had shown that the brown dog tick, *Rhipicephalus sanguineus*, was capable of transmitting anaplasmosis. The brown dog tick has only a limited distribution in the United States and has not been reported from several states where anaplasmosis has been enzoötic. On the other hand, *Dermacentor variabilis* is quite widely distributed, and this tick has recently been incriminated in the spread of a disease in man indistinguishable from Rocky Mountain spotted fever. These facts emphasize the desirability of further investigations on this tick as a potential vector of diseases of importance in both man and animals.

[1]Rees, C. W.: The experimental transmission of anaplasmosis by *Dermacentor variabilis*. Science, lxxv (March 18, 1932), p. 318.
[2]Rees, C. W.: The experimental transmission of anaplasmosis by *Rhipicephalus sanguineus*. No. Amer. Vet., xi (1930), 9.

VETERINARY JOURNAL IN ALTERED FORMAT

The January issue of *The Veterinary Journal* (London) appeared in changed format. The former long and narrow page, used since 1900, gave way to a broader page—one that is almost square. Technically the change is from a royal octavo to a crown quarto size. The paper also has been changed, the glossy finished stock having been replaced by one showing a rough surface.

The first number in the new garb is designated a "Special Poultry Number" and contains nine articles on poultry diseases and allied topics. Our good friend Frederick Hobday continues in the role of editor, with Gladstone Mayall as sub-editor.

WE MOVE AGAIN

This number of the JOURNAL was produced under rather unusual difficulties, brought about by transferring the official headquarters of the A. V. M. A. from Detroit to Chicago. As this is written, about half of our office equipment is in the Windy City and before this is read by our members the other half will be on its way.

The May issue will be published from Chicago and in that number we will tell you all about our new location. In the meantime we ask the indulgence of our members and correspondents, if letters and other communications are not answered immediately. They will be taken care of just as soon as possible. Thank you.

APPLICATIONS FOR MEMBERSHIP

(See January, 1932, JOURNAL)

FIRST LISTING

ARONSON, HARRY P. 261 W. Sunrise Highway, Freeport, N. Y.
D. V. M., Cornell University, 1927
Vouchers: C. E. Hayden and Bert J. Cady.

BERROTH, ELMO M. 1838 Walker Ave., Kansas City, Kans.
D. V. M., Kansas State College, 1920
Vouchers: B. F. Gooch and G. H. Randall.

ENGE, EDWIN C. F. 39th St. & Woodland Ave., Philadelphia, Pa.
V. M. D., University of Pennsylvania, 1931
Vouchers: G. A. Dick and W. J. Lentz.

FOSTER, EUGENE Z. 312 N. Eutaw St., Baltimore, Md.
D. V. M., United States College of Veterinary Surgeons, 1921
Vouchers: Earl M. Pickens and Hulbert Young.

HARE, H. CONRAD 4880 Hudson Blvd., West New York, N. J.
D. V. M., Colorado Agricultural College, 1926
Vouchers: Robt. S. MacKellar and D. A. Yandell.

MOULTHROP, IRWIN M. College, Park Md.
D. V. M., Cornell University, 1931
Vouchers: Alexander Gow, Jr., and E. M. Pickens.

WALLER, ERNEST F. University Farm, Saint Paul, Minn.
D. V. M., Iowa State College, 1931
Voucher: H. C. H. Kernkamp and R. Fenstermacher.

APPLICATION PENDING

SECOND LISTING
(See March, 1932, JOURNAL)

Hilbert, Arnold E., Candor, N. Y.

The amount which should accompany an application filed this month is $8.75, which covers membership fee and dues to January 1, 1933, including subscription to the JOURNAL.

COMING VETERINARY MEETINGS

San Diego-Imperial Veterinary Medical Association. San Diego, Calif. April 6, 1932. Dr. A. P. Immenschuh, Secretary, Santee, Calif.

New York City, Veterinary Medical Association of. Academy of Medicine, 5th Ave. and 103rd St., New York, N. Y. April 6, 1932. Dr. John E. Crawford, Secretary, 708 Beach 19th St., Far Rockaway, Long Island, N. Y.

Chicago Veterinary Medical Association. Atlantic Hotel, Chicago, Ill. April 12, 1932. Dr. E. E. Sweebe, Secretary, 14th St. & Sheridan Rd., North Chicago, Ill.

Kansas City Association of Veterinarians. Baltimore Hotel, Kansas City, Mo. April 12, 1932. Dr. J. D. Ray, Secretary, 1103 E. 47th St., Kansas City, Mo.

Southern California Veterinary Medical Association. Chamber of Commerce Bldg., Los Angeles, Calif. April 20, 1932. Dr. E. E. Jones, Secretary, 1451 Mirasol St., Los Angeles, Calif.

Keystone Veterinary Medical Association. Philadelphia, Pa. April 27, 1932. Dr. C. S. Rockwell, Secretary, 5225 Spruce St., Philadelphia, Pa.

Massachusetts Veterinary Association. Westminster Hotel, Boston, Mass. April 27, 1932. Dr. H. W. Jakeman, Secretary, 44 Bromfield St., Boston, Mass.

Connecticut Veterinary Medical Association. Hotel Elton, Waterbury, Conn. May 4, 1932. Dr. Edwin Laitinen, Secretary, 993 N. Main St., West Hartford, Conn.

Hudson Valley Veterinary Medical Society. West Point, N. Y. May 11, 1932. Dr. J. G. Wills, Secretary, Box 751, Albany, N. Y.

SOME FACTORS IN THE CONTROL OF COCCIDIOSIS OF POULTRY*

By FREDERIC F. FISH, *Baltimore, Md.*

Department of Protozoölogy, School of Hygiene and Public Health, Johns Hopkins University

DISCUSSION

Coccidiosis in the domestic hen, *Gallus gallus*, presents the most costly problem to the commercial poultryman. With the increasing demand for poultry and poultry products, and the resulting necessity for concentrating birds in more limited areas, the problem becomes more acute. To concentrate hosts means to create more favorable conditions for the transmission of the parasite, and the resulting devastating epizoötics of acute coccidiosis are well known to the poultryman.

The financial loss incurred by the mortality of young birds to acute coccidiosis is unquestionably great, but the stunting and weakening of many of the survivors is still greater. The percentage of culls, as direct results of coccidiosis among the pullets and older birds on any poultry farm, runs remarkably high.

To the parasitiologist, coccidiosis is an ideal and typical problem. The reservoir is found in the older birds acting as chronic carriers and disseminating a few oöcysts, which sporulate under favorable conditions, and may bring about the epizoötic of acute coccidiosis, especially if ingested by the younger birds.

Once acute coccidiosis becomes established in closely confined fresh hosts, it spreads with remarkable rapidity and can be checked in only two basic ways: first, by the removal of the infected birds from the flock, either by death, isolation or treatment; and secondly, by preventing the access of uninfected birds to the infective oöcysts by sanitation, or by the creation of conditions unfavorable for the development of the uninfective, unsegmented, freshly passed oöcysts into the mature, segmented, infective stage.

Isolation or death of the infected birds is a costly and obviously impractical method of control.

Treatment is, as yet, very little understood. It is not unlikely that a specific therapeutic for coccidiosis will eventually be

*This paper represents part of the author's work for the degree Doctor of Science, Johns Hopkins University. Preliminary report published in *Science*, March 13, 1931. Received for publication, April 4, 1931.

found and employed with a high degree of success, as quinine and its synthetic relative, plasmochine, have been utilized against malaria. However, such a therapeutic is not at hand at present, although many have been tried with generally negative results. The literature records the use of emetine, alcresta, animal charcoal, tannoform, quinine, magnesium sulfate, hydrochloric acid, bichloride of mercury, calcium hydroxide, medicinal methylene blue, cresol, formaldehyde, catechu, ipecac, areca nut, yatren, naganol novoarsenobenzol, thymol and others as therapeutics, with no definitely benefical results. Many commercial preparations are now on the market as specific cures for coccidiosis. Few of these have any exhaustive scientific investigation to their credit, and depend for their acceptance chiefly on testimonials from poultrymen who have tried them under uncontrolled, sporadic outbreaks of some poultry disease, not necessarily coccidiosis. Hence, such products must be considered as of doubtful value until subjected to a more exacting inquiry.

The possibility of a change in diet as a treatment for acute coccidiosis is of sufficient interest to warrant consideration, although, as yet, it has not been sufficiently investigated. Hegner (1924) and Ratcliffe (1928, 1929) have reported marked changes in Endamoeba, Chilomastix and Trichomonas infections in the rat by raising the protein content of the diet. Beach and C'Orl (1925) have recommended buttermilk in the diet as treatment for coccidiosis in the chicken, although Johnson (1923) and other workers have doubted its efficacy. It is a well-known fact that carnivores, as a rule, do not harbor coccidia of the genus Eimeria, and herbivores, as a rule, are not parasitized by coccidia of the genus Isospora, which may be explained reasonably, by their difference in diet and resulting differing conditions of acidity and flora of the intestinal tract. This phase of treatment and control of coccidiosis, namely by diet, seems a more promising method of attacking the problem at present, than does the hope for a specific therapeutic.

Unless sanitation is rigidly and thoroughly employed in a poultry-run, an undercurrent of acute coccidiosis results, which at any time may be expected to break out into a typical epizoötic. In large poultry establishments, strict sanitation represents a large economic factor which diminishes the net profits to the concern. The possibility of the prevention of coccidiosis seems greater than its control.

The exact conditions necessary for the development of the freshly passed, unsegmented oöcyst into the mature infective stage are but vaguely known, and practically nothing has been reported regarding the resistance of the oöcysts to factors in the environment. With this in mind, the writer has been directing his work towards finding a possible weak link in the parasitological cycle which may eventually be of economic significance in the control of coccidiosis in poultry.

The following series of experiments were undertaken in this laboratory on *Eimeria tenella*, the most pathogenic species of coccidium in chickens, isolated and described by Tyzzer, in 1929.

General Technic

A. The Concentration of Oöcysts

Segmented oöcysts: Oöcysts are collected in pans containing a two and one-half per cent aqueous solution of potassium dichromate under ½-inch wire-mesh cages containing chicks with acute coccidiosis. After collection, the dichromate and feces are thoroughly shaken, strained through two layers of coarse cheesecloth (surgical gauze), and centrifuged in 50-cc tubes at approximately 1600 r.p.m. The supernatant dichromate is then drawn off by suction and replaced with a saturated solution of sodium chloride and the contents of the tube thoroughly stirred. The material is again centrifuged at approximately 800 r.p.m. for one minute. The oöcysts are then found floating on the surface film of the salt solution and are syphoned into 15-cc centrifuge-tubes with a gooseneck glass tube. This method of collecting oöcysts from the surface film is far more satisfactory and efficient than the usual method of looping or its equivalent. With this tube, all the surface film is removed and nothing but the surface film. Tap water is then added to lower the specific gravity and the material centrifuged, after shaking, at high speed (1500 to 2000 r.p.m.) for two minutes. This throws the oöcysts to the bottom of the tube and the diluted salt solution may be syphoned away. The tube is then half filled with a 2½ per cent solution of potassium dichromate and incubated for 48 hours at 20°C. At the end of this time, all the live oöcysts are fully segmented and infective. This suspension of oöcysts (called by the writer, the "stock suspension") is then standardized by counting, under low power, the number of segmented oöcysts in a unit volume taken from the tube after a thorough shaking. The unit volume for standardization was arbitrarily chosen to be 0.075 cc, as

the Stoll pipette, as used by helminthologists, can be used, and this volume of liquid fits conveniently under a 7/8" square coverslip.

Unsegmented oöcysts: The same flotation and standardization technic is used as for the concentration of segmented oöcysts except the elapsed time between the first collection of feces and the final experiment is not over six hours. This allows a large factor of safety, as segmentation of the oöcysts is not visible before 17 hours after they have been passed from the host. At least 200 oöcysts from the stock suspension are examined immediately before each experiment, to be certain there is no evidence of segmentation prior to segmentation.

B. The Criteria for Mortality of Oöcysts

Segmented oöcysts: Immediately following experimentation, the segmented oöcysts are fed to chicks known to be coccidia-free from the time of hatching. The chicks are isolated in separate sterilized cages and every effort is made to prevent possible contamination during the prepatent period. There has been no indication throughout the reported experiments, and others, of contamination. At the end of the prepatent period, the chicks are placed in sterile wire-mesh cages for 24 hours and the accumulated feces concentrated and examined for oöcysts as reported under the concentration of oöcysts. With this technic, the lightest cases of coccidiosis could readily be detected. Duplicate examinations are run on all negative results. If an infection is established in not less than 165 hours in the experiment birds, but not in the accompanying uninfected control birds, the oöcysts are considered to have survived experimentation and the infection not one from contamination. If two successive examinations reveal no oöcysts, the infecting oöcysts are considered to have been killed by experimentation.

Unsegmented oöcysts: Immediately following experimentation, the unsegmented oöcysts are incubated at 20°C. for 72 hours. At the end of this period, approximately 200 oöcysts are examined under the high-dry objective of the microscope. All oöcysts which are unsegmented after the period of incubation are considered dead, as reëxamination after a prolonged period of incubation shows no evidence of further sporulation.

Two sets of controls are always included and the average number of unsegmented oöcysts found in these controls after incubation is considered to be the natural mortality of the oöcysts

in that particular stock suspension. This percentage of natural death is deducted from all experimental data, so figures given as mortality in succeeding experiments are all exclusive of this natural death, and hence represent the mortality due to experimental conditions only.

C. Calculations

Segmented oöcysts: Inasmuch as there are no mathematical calculations involved in experiments with segmented oöcysts other than standardizing the suspensions, all results with segmented oöcysts are expressed as: (+) signifying that one fresh bird had been fed a sufficient number of segmented oöcysts to produce an infection in the control animals and seven days later passed oöcysts; (−) denoting that one fresh bird had been fed the same number of oöcysts, but did not pass oöcysts on at least two successive examinations, each made after the prepatent period had expired; or (0) signifying the death of an experiment animal during the prepatent period. If two successive examinations proved negative, it was considered conclusive evidence that all the oöcysts in the infective dose had been killed by experimentation. There is no visible criterion available for the recognition of a dead oöcyst.

Unsegmented oöcysts: To eliminate the natural mortality during any experiment, as evidenced by the number of unsegmented oöcysts following incubation of the controls, each count in every experiment was adjusted as follows:

$$\left\{\begin{matrix}\text{N}\\ \text{The total number of oöcysts counted in each determination}\end{matrix}\right\} \times \left\{\begin{matrix}\text{Per cent natural mortality as shown by controls}\end{matrix}\right\} = \left\{\begin{matrix}\text{N1}\\ \text{Number of oöcysts which theoretically should be dead}\end{matrix}\right\}$$

$$\left\{\begin{matrix}\text{N2}\\ \text{Total number of oöcysts actually dead in each determination, } i.e. \text{ the number of unsegmented oöcysts counted}\end{matrix}\right\} - (\text{N1}) = \left\{\begin{matrix}\text{N3}\\ \text{Number of oöcysts killed by experimental conditions only}\end{matrix}\right\}$$

$$(\text{N}) - (\text{N1}) = \left\{\begin{matrix}\text{N4}\\ \text{Theoretical number of oöcysts alive}\end{matrix}\right\}$$

$$\frac{\text{N3}}{\text{N4}} = \text{Per cent mortality due to experimentation only}$$

Effects of Reagents on Unsegmented Oocysts

In an effort to determine the relative permeability of the oöcysts wall to various reagents and disinfectants, the following results were obtained (see table I).

Briefly, the technic involved was to add 0.5 cc of a standardized suspension of unsegmented oöcysts to 4.5 cc of the reagent in a 15-cc centrifuge-tube and incubate for the desired length of exposure at 20°C. At the end of the period, the tube was centrifuged at 2000 r.p.m. for three minutes, the supernatant reagent drawn off, the oöcysts resuspended in tap water, and again centrifuged. The washing in tap water was repeated to remove all traces of the reagent, and the oöcysts finally suspended in dichromate solution and incubated for 72 hours at 20°C. Following this period of incubation, the oöcysts were again concentrated by centrifugation and the sediment containing the oöcysts examined under the high-dry objective for evidences of sporulation. For other work on this subject, the reader is referred to the

TABLE I—*Effects of reagents on unsegmented oocysts. Figures given represent per cent mortality*

REAGENT	STRENGTH	HOURS OF EXPOSURE						
		1	4	6	8	12	24	48
$HgCl_2$	1%							100
$HgCl_2$	0.1%							18.4
Iodine Suspensoid (Old)	5%	100	100	100	100	100	100	100
Iodine Suspensoid (New)	1%	100		100			100	
NaOH	0.5N							0.5
NaOH	N							7.1
NaOH	2N							1.1
HCl	0.5N							1.3
HCl	N							0.0
HCl	2N							4.5
Chlorazene	1%							0.0
Chlorazene	4%							0.0
Formol	5%							40.5
Formol	2%							31.4
Cresol (Creolin)	2%	34.5	76.7		100	100	100	100
Cresol (Creolin)	5%	63.6	98.2		94.4	100	100	100
Cresol (Creolin)	10%							100
Phenol	2%	0.8	4.8		15.5	34.7	60.4	99.5
Phenol	5%	6.1		93.5			99.3	
$HgCl_2$ + HCl	0.1% 0.5%							10.5
Risor distilled Pine Oil	5%	0.7		12.8			52.5	
Yarmor distilled Pine Oil	5%	0.4		29.8			75.5	
Penn-o-pine	5%	0.0		0.0			45	
Alpha Terpinol	5%	2.0		4.8			73.1	
Fenchyl Alcohol	5%	0.0		0.0			29.4	
Tarol	5%	0.0		0.0			13.4	
Middol	5%	2.5		41.6			68.7	
Residol	5%	6.8		34.8			83.7	
Medium Cresote Oil	5%	61.5		85.4			100	

publications of Perard (1924), Johnson (1923), and Beach and C'Orl (1925).

Thermal Death Times

There have been few data published concerning the resistance of the oöcysts of coccidia to heat. The general opinion prevails that the segmented oöcyst is more resistant to heat than is the unsegmented one. Johnson (1927) states that cecal material containing unsegmented oöcysts heated to 75°C for one minute killed the parasite. Also, that potassium dichromate cultures of segmented oöcysts were killed by heating at 75°C. for ten minutes. Perard (1924) states that oöcysts are killed at 40°C. (time not given) and that segmented oöcysts are more resistant than normal non-segmented ones.

The term "thermal death time" is used in preference to the customary "thermal death point" following the suggestion by Esty (1928) that there is no one time and temperature combination that alone may be defined as the thermal death point. Obviously, the time varies with the temperature at which the organisms are heated. The term thermal death time, first used by Bigelow (1921) and later by Esty and others, seems more applicable.

The technic used for these determinations was to heat a 15-cc centrifuge-tube containing 4.5 cc of a 2½ per cent solution of potassium dichromate to the desired temperature in a water-bath. When the thermometer-tube reached the desired temperature, 0.5 cc of a suspension of oöcysts was added, care being taken that all the suspension went into the dichromate. The temperature was watched continuously for ten minutes and the tube immediately placed in cold running water. The control tubes were maintained unheated.

Segmented oöcysts were washed in tap water and immediately fed to fresh chicks. The tubes containing unsegmented oöcysts were incubated for 72 hours at room temperature and the resulting sporulation observed under the microscope. See tables II and III for results.

The Ratio Between Heat and Mortality

Inasmuch as the thermal death time for any one given unit of time is of little consequence and of limited application, a more extensive protocol was outlined to find the shortest time at which a 100 per cent mortality of oöcysts could be effected at temperatures ranging from 35 to 90°C.

The technic involved was identical to that used in the determination of the thermal death time except for the time factor.

The results are tabulated in tables IV and V and the comparative results shown in graph 23 (fig. 1).

It may be noted that precise work at less than five seconds is almost an impossibility because of the crudeness of the apparatus.

TABLE II—*Thermal death times. Segmented oocysts. (time of exposure—10 minutes)*

CHICK	TEMPERATURE	INFECTION
178	40°C	+
179		+
137	45°C	+
170		+
152	51°C	+
121		+
240	51.5°C	+
241		+
242		+
243		+
244	53°C	—
245		+
246		0
247		—
248	54°C	—
249		—
250		—
251		—
252	55°C	—
253		—
254		—
255		—
139		—
150		—
256	56°C	—
257		—
258		—
259		—
260	Controls (Unheated)	+
261		+
262		+
263		+
264	Controls (Uninfected)	—
265		—
266		—
267		—

0 = Bird 246 died two hours after infection.

TABLE III—*Thermal death times. Unsegmented oocysts. (time of exposure—10 minutes)*

TEMPERATURE	PER CENT MORTALITY EXCLUSIVE OF NATURAL MORTALITY
41°C.	0.0
46°C.	5.2
50°C.	36.4
51°C.	23.5
53°C.	100.0
54°C.	100.0
55°C.	100.0
Controls (Unheated)	0.0

RESISTANCE OF OOCYSTS TO ULTRA-VIOLET RAYS

Under natural conditions, oöcysts are likely to come in contact with the sun's rays. The ultra-violet fraction of solation is well

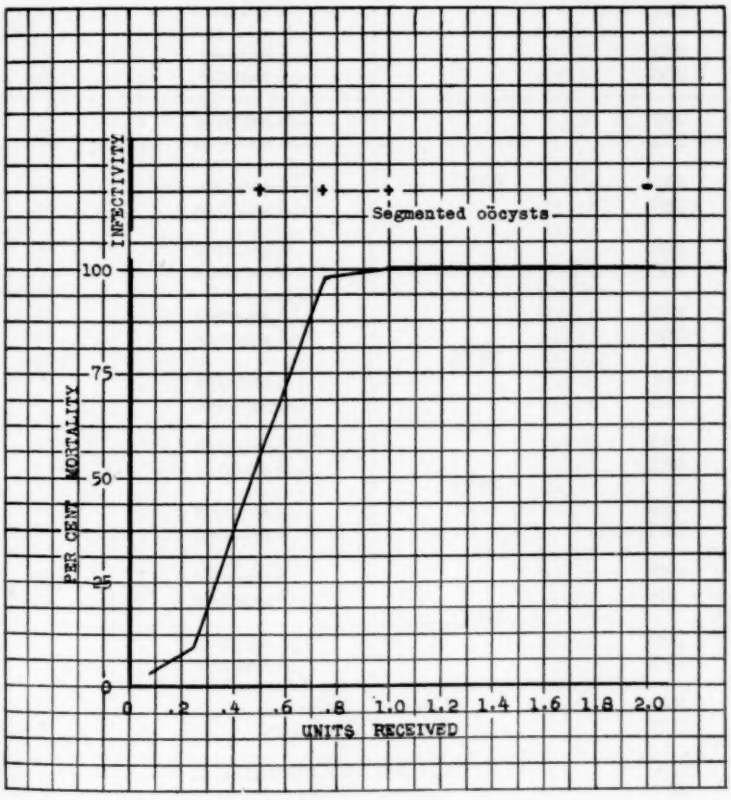

Fig. 1. Thermal death curves (graph 23).

known to be lethal to protoplasm. There has been little reported on the resistance of coccidial oöcysts to ultra-violet. Haughwout (1921) states that development occurred in *Isospora hominis* oöcysts after seven daily exposures of three hours each to sunlight in the Philippine Islands. Inasmuch as the actual ultra-violet content of the sun's rays is such a variable factor, even from hour to hour during the same day, little knowledge is therein contributed to the lethal limit of the oöcysts. To control the variation in ultra-violet content of the sun's rays caused by clouds, dust particles, and other insulators, a cali-

TABLE IV—*Thermal death times for segmented oocysts*

CHICK	TEMPERATURE	TIME OF EXPOSURE	INFECTION
349	55°C.	5 minutes	—
350		5 minutes	—
351		3 minutes	+
352		3 minutes	+
353		1 minute	+
356		1 minute	+
372	60°C.	20 seconds	—
373		20 seconds	—
357		15 seconds	+
358		15 seconds	+
354		5 seconds	+
355		5 seconds	+
359	70°C.	15 seconds	—
360		15 seconds	—
361		5 seconds	—
362		5 seconds	—
363	80°C.	5 seconds	—
364		5 seconds	—
365		3 seconds	—
366		3 seconds	—
367	90°C.	5 seconds	—
368		5 seconds	—
369		3 seconds	—
370		3 seconds	—
374	Control (Unheated)		+
375	Control (Unheated)		+
376	Control (Uninfected)		—
377	Control (Uninfected)		—

brated General Electric quartz mercury arc lamp was used at a working distance of 22 inches. The zinc sulfide unit of Clark (1929) was chosen as the unit of calibration, which was furnished by this lamp and this distance in 66 seconds.

The oöcysts were suspended in a minimum amount of water on ¾" square cover-slips to the direct rays from the lamp and as each unit, or fraction thereof, was delivered, the cover-slips for

TABLE V—*Thermal death times for unsegmented oocysts*

At 35°C., normal development followed. At 41°C., there was no development, but many of the oöcysts were not killed during a 48-hour exposure*

TEMPERATURE	TIME OF EXPOSURE	PER CENT MORTALITY EXCLUSIVE OF NATURAL MORTALITY
45°C.	24 hours	100.0
	2 hours	14.4
	1 hour	15.1
	30 minutes	5.6
50°C.	90 minutes	100.0
	60 minutes	97.2
	40 minutes	95.4
	20 minutes	53.1
	10 minutes	34.9
55°C.	10 minutes	100.0
	5 minutes	100.0
	3 minutes	100.0
	1 minute	90.0
	30 seconds	64.2
60°C.	5 minutes	100.0
	3 minutes	100.0
	1 minute	100.0
	30 seconds	100.0
	15 seconds	100.0
	5 seconds	99.0
70°C.	30 seconds	100.0
	15 seconds	100.0
	5 seconds	98.7
	3 seconds	98.2
80°C.	15 seconds	100.0
	5 seconds	100.0
	3 seconds	98.5
	15 seconds	100.0
	5 seconds	100.0
	3 seconds	96.5
	1 second	97.6

*Inasmuch as 41°C. approximates the body temperature of the host, it may offer a satisfactory explanation as to why there is no development of the oöcyst in the host, even after confinement for four days as described by Young (1929). Lack of oxygen in the rectum of the host has been suggested as an explanation by Young, but the body temperature seems more applicable, as in warm-blooded hosts, oöcysts are seldom, if ever, passed in a segmented condition, but in cold-blooded hosts they are usually segmented when voided.

that exposure were covered with a glass slide. The control cover-slips were kept similarly insulated from the rays throughout the experiment. In this manner, all the oöcysts were exposed to exactly the same conditions, except for the amount of ultra-violet rays received. There was no factor involved that could in any way be construed as being lethal, other than the rays. The oöcysts used in this experiment were re-floated on concentrated saline solution to remove as much débris as possible before experimentation. Approximately 200 oöcysts were used on each cover-slip to avoid any possibility of blanketing.

Immediately following irradiation, the cover-slips bearing the unsegmented oöcysts were placed in a moist chamber, which eliminated evaporation, and 72 hours later were examined for sporulation. The segmented oöcysts were picked up in sterile gelatin as a coalescent with fresh sterile capillary pipettes and fed to fresh chicks. To avoid missing light infections, due to the comparatively few oöcysts fed, the pooled feces were collected from each bird from the seventh to the twelfth day following infection and examined for oöcysts by concentration methods as previously described.

TABLE VI—*Effect of ultra-violet rays on segmented oocysts*

CHICK	UNITS RECEIVED BY INFECTING DOSE	INFECTIONS
600	½	+
601		+
602		+
604		+
605	¾	+
606		+
607		Died
608		+
609	1	+
610		+
611		Died
612		+
613	2	—
614		—
615		—
616		—
617	Infected Controls	+
618		+
619	Uninfected Controls	—
620		—

The results are shown in tables VI and VII, and the comparative results on graph 24. (fig. 2)

The fact that the segmented oöcyst can withstand more than the lethal irradiation of the unsegmented oöcyst is explainable by the fact that the unsegmented oöcyst has but a single cyst-wall to be penetrated, while the segmented oöcyst has two, namely, the oöcyst wall and the sporocyst wall.

Immunity and Resistance

The question of immunity and resistance of the host to coccidiosis is not settled. No specific immunological tests have been

Table VII—*Effect of ultra-violet rays on unsegmented oocysts*

Material	Units Received	Per Cent Morality Exclusive of Natural Mortality
Control 1	0	0.0
Control 2	0	0.0
Control 3	0	0.0
Control 4	0	0.0
Slide 1	¼	8.22
Slide 3	½	53.43
Slide 4	½	54.75
Slide 5	¾	98.83
Slide 6	¾	100.0
Slide 7	1	100.0
Slide 8	1	100.0
Slide 9	1	100.0
Slide 10	1	100.0
Slide 11	2	100.0
Slide 12	2	100.0
Slide 13	3	100.0
Slide 15	4	100.0
Slide 19	6	100.0
Slide 21	7	100.0
Slide 23	8	100.0
Slide 25	9	100.0
Slide 28	10	100.0

Temperature at start = 28°C.
Temperature at finish = 32.5°C.

applied to coccidia in the chicken and conclusions concerning the factors of immunity and resistance are limited to observations following initial and repeated infections. A résumé of the work reported by Tyzzer (1929), Young (1929), Johnson (1927) and others indicates that specific immunity is developed by acute coccidiosis in the chicken, especially in the deeply penetrating species of coccidia, but this immunity is comparatively slight, and is not, for the most part, sufficient to protect the host against subsequent infections.

Immunity to coccidiosis in other hosts, namely the rabbit, has been more thoroughly investigated. Chapman (1929) found no demonstrable antibodies to rabbit coccidiosis in complement-fixation, agglutinin, precipitin or lysin tests. She suggests that some immunity may be gained by light infections, although the mechanism cannot be explained by antibodies in the circulating blood. Bachman (1930) obtained inconclusive results as to antibody formation in complement-fixation, precipitin, benzoin-flocculation, index of refractivity, and serum-surface-tension tests, using a more potent antigen. He found precipitins in high dilutions in rabbits artificially immunized, but the artificially infected rabbits were uniformly negative in precipitin tests. Andrews (1926) reports a single attack of acute coccidiosis in both cats and dogs rendered the hosts immune to further infections for at least seven months and probably for life. However, the same author, in a later paper (1930), admits that both

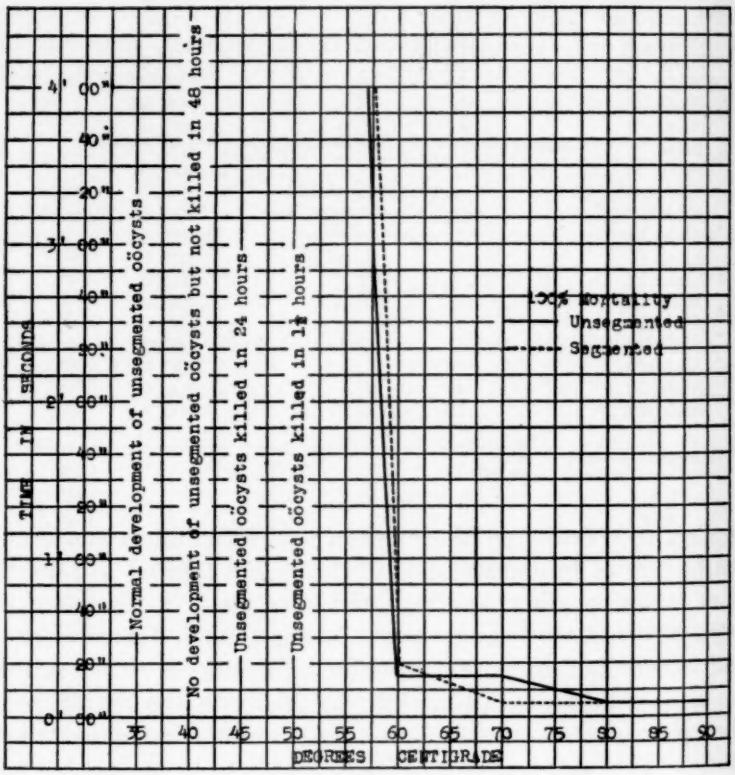

Fig. 2. Resistance of oöcysts to ultra-violet rays (graph 24).

cats and dogs, maintained in the laboratory for a year or more, show evidence of repeated attacks of coccidiosis with intervening periods of apparent freedom from the disease. This seems to indicate that his former conclusion was erroneous, or that there is present in coccidiosis a factor of relapse, as in malaria. This factor has not been considered in coccidiosis previous to last year.

The writer has made no exhaustive inquiry into the subject of immunity to coccidiosis in chickens, but several observations may be of interest.

Thirteen birds of the same breed were given approximately equal numbers (measured) of segmented oöcysts. Six of the birds were two weeks old and had previously been kept free from infection. The remaining seven were three weeks old and had survived one attack of coccidiosis, the patent period of which started eight days before the second infection was given. All birds were kept under identical conditions in isolated cages. Six of the seven previously infected birds died within forty-eight hours, whereas only two of the six initial-infection birds succumbed.

In another series of observations, two birds with the same clinical history as the seven in the above experiment were fed 500 segmented oöcysts. A third bird, likewise previously infected, was maintained without further infection as a control. Two fresh birds, one week younger, were fed a similar dose of oöcysts and a third bird kept uninfected as a control. The conditions surrounding the birds were identical, although, as a whole, the temperature was some 10°C. colder and the birds were on wire-mesh floors instead of the sawdust to which they had been accustomed. All three of the previously infected birds died within forty-eight hours and all three fresh birds lived. While these observations are by no means conclusive, they indicate that one attack of coccidiosis certainly does not prevent a second, and hosts, weakened by one attack of the disease, cannot withstand a second attack that in itself does no visible injury to normal birds, nor can the hosts, so weakened, withstand as severe an external environment as can birds undergoing their first attack.

In all probability, the self-limitation of the life cycle of the parasite, and the general condition of the bird is of more importance than is immunity. The work of Tyzzer (1929), indicates that the parasite goes through a definite number of asexual generations, followed by the production of sexual forms which cannot

reproduce in the same host. In this manner, the life of the parasite in the host is limited, and specific antibodies are unnecessary as a curb to the disease. If the condition of the host can withstand the ravages of the asexual generations of the parasites, the host will survive. Hence, the host seems to be passive in removing the infection, and specific antibodies are not necessary and merely the result of the introduction of a foreign protein and without significance as a defense mechanism.

The Prevention and Control of Coccidiosis

Sanitation is still the cardinal point in the control of coccidiosis. The term sanitation, however, is frequently misinterpreted by the poultryman. He feels because he has removed the litter from his poultry-runs once or twice a week, he should have little or no coccidiosis in his flock. Unquestionably, this removal will eliminate some of the disease, but it will by no means eradicate it, even to a sub-clinical level. A more intelligent application of sanitation, namely, to clean out the favorable localities for the sporulation of the oöcysts will do much to control coccidiosis. Of the three factors necessary for sporulation—temperature, oxygen and moisture—the latter is the easiest to control.

The open type of drinking-fountain is perhaps the most pernicious aid to the transmission of the oöcyst. It is easily and always contaminated by droppings and it furnishes an ideal place for the oöcyst to develop and be ingested by a new host.

The judicious use of a wire mesh large enough to permit the passage of droppings, yet small enough to prevent the access of the host to the droppings, is a highly effective weapon against the disease. It is advocated where the birds congregate, especially at the water-fountain, the feed-troughs, and under the roosts.

Sand and cinders, which do not retain moisture, make a more favorable foundation for a chicken-yard than does clay, which does not readily dry out. The runs should be exposed to sunlight as much as possible. While shade is perhaps advantageous to the chicken, it is also advantageous to the parasite.

The chief fight against coccidiosis in chickens should be with the young birds. The greatest loss from the disease comes in the birds under two months of age. It is not so important to remove a stunted bird from the flock as it is a bird known to be passing bloody droppings. The point raised by Connal (1922) and furthered by Andrews (1927) and others, that symptoms are over before oöcysts appear in the feces, is especially worthy of note.

The liberal use of a disinfectant, known to be effective against the oöcyst, is beneficial.

Summary

1. Damage by poultry coccidiosis is not confined to the acute cases, and is greater, economically, as a cause of stunted and permanently weakened birds.

2. The oöcysts of *Eimeria tenella*, and presumably all other species of chicken coccidia, do not appear to be so resistant as is commonly believed. They are highly resistant to chemicals but are very susceptible to physical agents.

3. Both segmented and unsegmented oöcysts of *Eimeria tenella* are killed at 55°C., in ten minutes. The segmented oöcysts are not significantly more resistant to heat than are the unsegmented oöcysts.

4. Mortality of oöcysts by heat is directly proportional to the degree of heat used. Exposure for twenty seconds to 60°C. and for three seconds to 80°C. will kill both the segmented and the unsegmented oöcysts.

5. The fact that oöcysts will not develop within the body of warm-blooded hosts is probably due to the body temperature, and not to the lack of oxygen.

6. Neither the segmented nor the unsegmented oöcyst is very resistance to ultra-violet rays. The segmented oöcyst is more resistant than is the unsegmented. Two zinc sulfide units of ultra-violet rays are sufficient to kill both segmented and non-segmented oöcysts.

7. The self-limitation of the life cycle of the parasite in the host and the general vigor of the host seem more important in controlling the disease than does the possibility of the development of a specific immunity.

8. In preventing coccidiosis, more attention should be given to the localities which furnish ideal places for the sporulation of the oöcyst.

Acknowledgments

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SOME FURTHER EXPERIMENTS WITH LUMBAR ANESTHESIA IN CANINES*

By H. D. SMILEY, *Waynoka, Okla.*

During Prof. Dr. Franz Benesch's study and visit in America, in 1926, he demonstrated in cattle the use of the form of regional anesthesia now known as epidural, extradural, caudal, or Benesch anesthesia. Drs. Frank and McLeod,[1] of Kansas State College, realizing its possibilities, extended it to dogs, cats and swine in the form of lumbar anesthesia. Upon the author's arrival in Vienna, he found that it had been tried in only a few dogs, with no success, so it was decided to experiment, using tutocaine, which is the accepted local anesthetic in Austria. The work of Frank and McLeod was done with procaine.

The criticism has been offered that this form of anesthesia would undoubtedly affect the spinal nerves but not the sympathetic, and, therefore, the anesthesia would not be effective for certain operations upon abdominal organs. To quote from Sisson[2]:

> The lumbo-sacral plexus (in the dog) is formed from the ventral branches of the last five lumbar and the first sacral nerves. . . . The sympathetic system presents few special features worthy of mention (as compared with the horse).
>
> (In the horse): The abdominal part of the sympathetic trunk. . . . which are connected by rami communicantes with the ventral divisions of the lumbar nerves. Visceral branches go to the aortic and pelvic plexuses and to the coeliaco-mesenteric ganglion.
>
> The abdominal aortic plexus . . . . It is connected with the renal and behind with the pelvic plexus. It receives filaments from some of the sympathetic lumbar ganglia.
>
> The pelvic plexuses are the pelvic continuations of the aortic and posterior mesenteric plaxuses. Two or more nerves proceed from the posterior mesenteric ganglion and enter the pelvic cavity ventral to the large vessels, anastomose with each other and with branches from the sacral nerves . . . and ramify on the pelvic viscera.

We quote no further, as this suffices to show that the sympathetic and spinal nerves of this region are intimately and intricately connected, and from all clinical evidence this seems to be sufficient. It is well known that it is sufficient, from a clinical standpoint, in the horse and cow.

PRELIMINARY DISCUSSION

Due to local conditions, it was impossible to obtain a large number of dogs with which to carry on the work, so a few dogs

*From the Geburtshilflichen Klinik Vorstand, Prof. Dr. F. Benesch, Tierarztliche Hochschule, Vienna, Austria. Received for publication, June 24, 1931.

were acquired and injections made every two or three days. As repeated injections were thus made necessary in each dog, it was obviously impossible to perform operations upon them in order to ascertain exactly what degree of anesthesia was present. Therefore it was obligatory to rely upon external manisfestations.

Several logical objections may be offered to this method. First, a perfect anesthesia of the external regions might be present but the amount of anesthesia of the internal organs, peritoneum, and so forth, need not necessarily be the same. Second, the subjects might develop an abnormal sensibility or resistance to tutocaine under this repeated administration. In order to offset these two factors a dog was discarded as soon as we believed that he exhibited any abnormal reaction and when we thought that we had found a percentage and amount that promised results, it was applied to an actual, clinical case in which an operation was deemed necessary.

An anesthesia of at least 45 or 50 minutes was desired. In the subjects of experiment the duration was sometimes difficult to determine, especially those tests in which only a moderate degree of anesthesia was evident. So the rule was adopted that upon the first sign of any return towards the normal state of sensibility, the anesthesia was considered to be at an end. This perhaps has led to some erroneous conclusions. The sensory nerves invariably begin to regain their functional powers in advance of the motor nerves. But the question of when the sensory nerves are functioning to the extent of conveying an impression of pain and when they are exhibiting only reflex action (such as twitching of the vulva when the rectal mucous membrane is grasped with forceps), or if the reflex powers and the ability to convey a definite impression are identical, is puzzling. So, in the end, the court of last resort was the operating-table.

Injection Procedure

For two very important reasons it is impractical to make the injection in the dog in the same place as in the horse and cow, namely, the sacro-coccygeal or first intercoccygeal space. The first of these reasons is the fact that the sacrum and the first few coccygeal vertebrae in the horse and cow are directed upward posteriorly and the solution may flow forward to the lumbo-sacral plexus, while in the dog these structures are directed somewhat ventrally. Secondly, the intervertebral spaces of this region of the dog must necessarily be exceedingly small and the conforma-

tion of the body would hinder further the correct insertion of the needle.

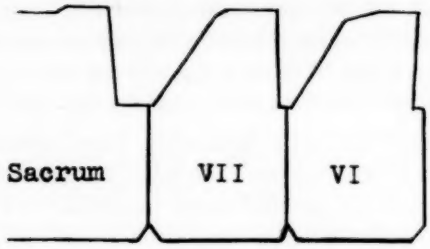
Following the method of Frank and McLeod, we chose the lumbo-sacral articulation. On study of skeletons and dissections, it was found that this space was relatively large, while the next space anterior to this (the space between the sixth and seventh lumbar vertebrae) is very small. It is impossible to insert a needle immediately posterior to the lumbo-sacral articulation, as the sacrum of the dog consists of three very well fused vertebrae.

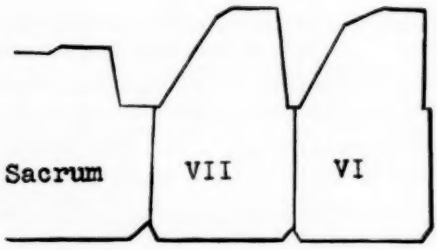
Frank gives very lucid accounts of the method by which to determine the site of injection. The first part is essentially as follows: With the dog in the standing position palpate the posterior angles of the wing of the ilium which are very close to the sacrum. On a line drawn between these two points, or 1 to 1.5 cm. posterior to this line, a distinct depression may be felt. This is the true and proper point to make the insertion of the needle. To a person who is inexperienced this may feel too slight and indistinct and then he may search a little forward and encounter a large and easily palpable depression in which he proceeds to insert the needle. If this be the case, he has inserted the needle between the sixth and seventh lumbar vertebrae and a great deal of patience, time and probing is necessary to locate the small space existing between these vertebrae. Perhaps in the end the result is the same, after he has the needle in the spinal canal and has made the injection of the solution, as the solution would tend to flow in both directions, but the mistake should be avoided because of the aforementioned difficulties.

In the accompanying sketches we have attempted to illustrate these points.

Figure 1 represents the sixth and seventh lumbar vertebrae and the sacrum. It is drawn schematically in order to illustrate to a better advantage the danger of inserting the needle between the sixth and seventh vertebrae instead of between the seventh vertebra and the sacrum.

The reader will notice that the top of the spine of the sixth vertebra is broad and the posterior angle is rounded to a considerable extent, while the spine of the seventh is more pointed. There can be noticed also that there is a great difference in the actual spaces between these three spinous processes. But due to the rounded posterior angle of the sixth spine, the proximity of the wings of the ilium, the mass of lumbar muscles which are so greatly developed in many dogs, and the various ligaments which





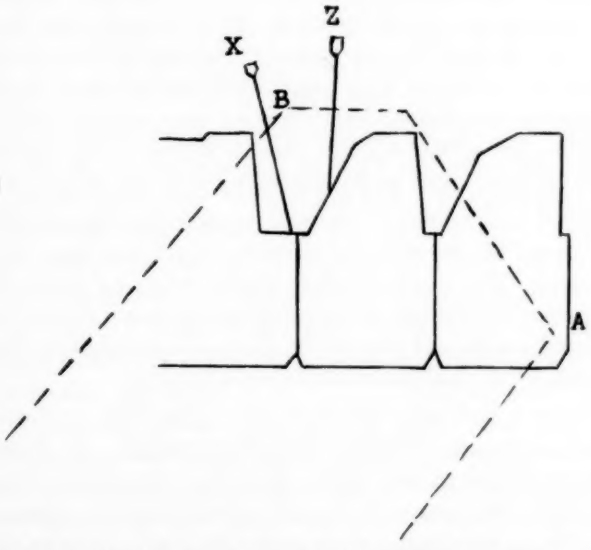


Fig. 1 (above). Sixth and seventh lumbar vertebrae and sacrum.
Fig. 2 (middle). Sixth and seventh lumbar vertebrae and sacrum (processes lower).
Fig. 3 (below). Land marks for the point of injection.

seem to be strongly developed over this important lumbo-sacral articulation, it is easy for the inexperienced or hasty operator to make the error of mistaking the forward space (between the sixth and seventh vertebrae) for the desired posterior one.

It is, perhaps, the ligaments which principally bridge and obscure this large space. Though the spaces between the more anterior spinous processes can be palpated easily, nature seems to have reinforced this one specially by developing the normal ligaments to a greater degree. The following ligaments seem to be the principal ones (Sisson):

> The interspinous ligaments extend between the spines of contiguous vertebrae . . . and lumbar regions they consist of white fibers directed obliquely downward and backward.
>
> The supraspinous ligament extends medially from the occipital bone to the sacrum. Behind the withers it consists of a strong cord of white fibrous tissue, attached to the summits of the vertebral spines.
>
> Longissimus dorsi (muscle)— . . . It extends from the sacrum and ilium to the neck . . . Origin— . . . the first three sacral spines . . . Structure— . . . This (the posterior part of the muscle) is covered by a strong aponeurosis which blends with the supraspinous and sacro-iliac ligaments, and is attached to the crest and sacral angle of the ilium and the first and second sacral spines.

There is one other ligament of which we are aware but of which no mention can be found in any anatomy text. We believe that it can be said to exist at every vertebral articulation. It is the ligament covering this large lumbo-sacral space and in that way making the articulation stronger and contributing its share to making the spinal canal a closed cavity. This ligament can be very distinctly felt as the needle strikes and passes through it.

Figure 2 is the same as figure 1 except that the sacral spinous processes are shown as being considerably lower than the lumbar processes. This is a condition which exists in many dogs and further complicates the selection of the proper location, but upon careful palpation and especially after a few injections have been made this error can be avoided very easily.

In figure 3 the wing of the ilium (indicated by dotted lines) has been shown in relation to these vertebrae. It furnishes an important guide to one when choosing the point of injection. The lower angle (A) is the point which can be palpated in the upper part of the flank, while angle B is very close to the spinal column and is usually not so distinct upon palpation as A. Sometimes the wing of the ilium does not extend above the spinous processes as shown, but is practically level with them and in a few cases may be a little lower. We recommend that the needle be inserted in the direction indicated in figure 3 by X

as then it will proceed directly into the spinal canal. If a point a little farther forward is chosen, with the thought in mind to make a vertical insertion of the needle, the danger is always present of choosing a site such as indicated by Z, in which case the needle must be withdrawn a little and the posterior aspect of the process followed down to the lumbo-sacral space. It is very easy for the needle to slide off this pointed, ridged posterior aspect and become imbedded in the lumbar muscles.

The second part of the method described by Frank for making the injection is as follows: With a hypodermic needle, the size of which is compatible with the size of the dog, start the insertion in the palpated depression at an angle of about 15 or 20 degrees from the perpendicular, and *in exactly the median plane.* Proceed very slowly so that the progress of the point of the needle can be felt. Finally the operator can feel it pass through a tough ligament, proceed freely and with no hindrance, then, after a short distance, which depends on the size of the dog, strike bone. The dog may wince as the needle goes into the spinal cord. These indications, together with the amount of force necessary to operate the syringe, should afford the operator conclusive evidence of the position of the needle: whether it is in the spinal canal or not. In case it is *in the canal* the syringe can be emptied *as easily as if it were being emptied into open air.*

The length of the needle, of course, varies. In general one can say that the shortest should be at least an inch long while the longest need not be longer than 2½ inches. The diameter should be in harmony with the length.

There is one point repeatedly stressed by Frank which we feel can not be emphasized too much. *The solution must be injected slowly,* as otherwise convulsions may occur. For this reason a glass syringe should be used, as one can gauge force and pressure more accurately, and it also should be of small capacity (5 or 10 cc). With a larger syringe one injects faster than he realizes. The safest method is to inject 0.5 cc, then pause for one or two seconds, inject another 0.5 cc and so on. With large dogs requiring, let us say, 15 cc, more than 0.5 cc can be safely injected at a time if one uses judgment. It hardly needs to be said that the injection must be done under absolutely aseptic conditions.

Discussion of Tests

At the beginning of the tests we were confronted by two problems: the quantity of solution to be injected, and the concentra-

tion of tutocaine in this solution. It is the amount of the anesthetic which comes into contact with the nerves that causes the anesthesia, but yet the anesthetic had to be dissolved in a fluid. If too small a quantity of liquid was injected, it would remain in one place and only a few nerves would be affected instead of all the nerves supplying the posterior part of the body, or it would spread out and affect all the nerves only slightly. If too much fluid was injected it would tend to flow forward and thus affect the medulla oblongata or the brain proper. Death might ensue from this.

In the accompanying x-ray plates the distribution of an injection of jodipin is shown. Jodipin is an iodin preparation which is visible under the x-ray and causes no deleterious effects when injected intraspinally. A young, black, mongrel male, weighing 7.4 kilograms, was given 10 cc. In figure 4 the jodipin is the

Fig. 4. Black line indicates location of jodipin.

black line originating immediately anterior and posterior to the point of the needle. In figure 5 this line can be seen to extend as far forward as the atlanto-axial articulation. This clearly proves the supposition that an injudicious injection of an anesthetic would be lethal, as it would involve the medulla oblongata. The reader should not be misled on two points by this photograph. The sacrum and coccygeal vertebrae do not normally slope upward. In taking the picture the hind legs were extended, as indicated by the position of the two femurs and the pelvis, therefore there is not a normal relation existing between the parts. For still another reason figure 4 is valuable. It was taken only a few days after experiments were started and demonstrates the ease with which the inexperienced can choose the wrong depression on palpation. In this plate the needle is inserted

Fig. 5. Injection shown as far forward as the atlanto-axial articulation.

between the sixth and seventh lumbar vertebrae. Figure 6 shows the proper position of the needle.

For the purpose of this work the degree of anesthesia has been classed as none, poor, medium, good, and excellent. It is very difficult to establish an ironclad, inflexible standard for the interpretation of these results and a great deal depended upon the observer's general impression at the time. In the main, we can give the following definitions of the terms:

None: Definition is obvious.

Poor: Anesthesia of tail; instability or lack of coördination of the hind legs.

Medium: Anesthesia of tail; inability to stand; and moderate amount of anesthesia of skin.

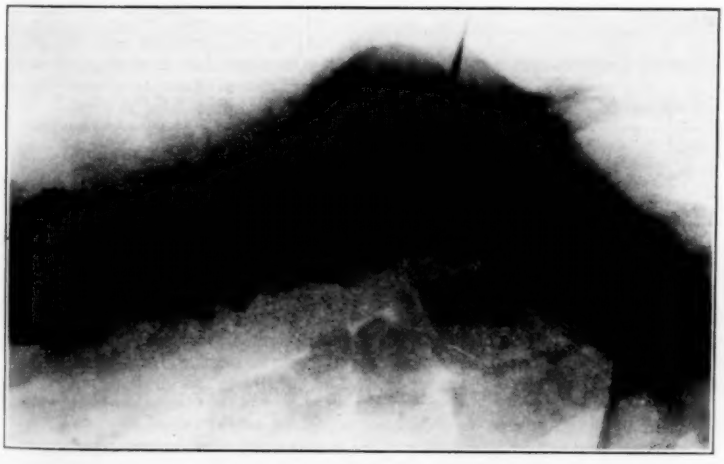


Fig. 6. Proper position of the needle.

TABLE I

Test	Date	Age	Weight (Kilo)	Amount Inj. (cc)	Ratio	Anesthesia			After-Effects			Note
						Took Effect (Mins.)	Duration (Mins.)	Quality	6 Hrs.	1 Day	2 Days	
1	2–10	A	13.0	5.0	1:2.6	15	25	Poor	–	–	–	
2	2–10	Y	7.3	3.0	1:2.43			None	–	–	–	1
3	2–12	Y	7.4	3.0	1:2.46			None	–	–	–	2
4	2–12	A	13.0	4.0	1:3.25	3	50	Med.	–	–	–	3
5	2–14	Y	7.4	3.0	1:2.46	2	25	Exc.	–	–	–	4
6	2–16	A	13.0	7.0	1:1.85	2½	30	Exc.	–	–	–	5
7	2–17	Y	7.4	4.0	1:1.85	2	25	Exc.	–	–	–	6
8	2–18	A	13.0	3.0	1:4.33	2½	20	Med.	–	–	–	7
9	2–19	Y	7.4	2.0	1:3.72	3	20	Poor	–	–	–	8
10	2–20	A	13.0	8.5	1:1.53	2	25	Good	–	–	–	9
11	2–21	Y	7.4	5.0	1:1.48	1½	25	Good	Note 9		–	10
12	2–25	Y	7.4	3.0	1:2.46	4	20	Good	–	–	–	11
13	3–3	O	25.7	5.0	1:5.14	8	25	Med.	–	–	–	12
14	3–4	O	27.5	5.0	1:5.5			None	–	–	–	13
15	3–5	Y	7.4	3.6	1:2.06	4	17	Med.	–	–	–	14
16	3–6	O	25.7	7.8	1:3.29	6	25	Good	–	–	–	15
17	3–6	O	27.5	8.5	1:3.23			None	–	–	–	16
18	3–9	O	25.7	10.0	1:2.57	4	27	Med.	–	–	–	17
19	3–9	O	27.5	10.0	1:2.75	4	32	Exc.	–	–	–	
20	3–12	O	25.7	12.5	1:2.05			None	–	–	–	18
21	3–12	O	27.5	12.5	1:2.2	5	35	Good	–	–	–	19
22	3–12	O	25.7	5.0	1:5.14	3	35	Exc.	–	–	–	20
23	3–14	O	27.5	15.0	1:1.83	5	25	Poor	–	–	–	21
24	3–14	O	25.7	15.0	1:1.71	4	25	Good	–	–	–	22
25	3–16	O	27.5	17.5	1:1.57	3½	30	Exc.	–	–	–	23
26	3–16	O	25.7	17.5	1:1.47	3	25	Good	–	–	–	24
27	3–18	O	27.5	14.0	1:1.96			None	–	–	–	25
28	3–18	O	25.7	8.0	1:3.21	12	40	Exc.	–	–	–	26
29	3–18	O	27.5	14.0	1:1.96	5	25	Exc.	–	–	–	27
30	3–21	O	25.7	12.5	1:2.05	2	20	Poor	–	–	–	28
31	3–21	O	27.5	14.0	1:1.96	3	30	Exc.	–	–	–	29
32	3–23	Y	7.4	3.5	1:2.11			None	–	–	–	

Y = Young.
A = Adult.
O = Old.

Med. = Medium.
Exc. = Excellent.

Good: Anesthesia of tail; inability to stand; anesthesia of skin and mucous membranes of region but some muscle tone, or vice versa; reflexes still present.

Excellent: Complete anesthesia and relaxation of hind quarters with no reflexes present.

If no anesthesia had set in at the end of 30 minutes after injection, the test was entered under the classification "none," as we felt that even if anesthesia did set in after that length of time it would have no practical value.

Notes on Table I

1. Subject is of a nervous temperament and continually moved and jerked during the injection of the solution. All the solution may not have been injected into the canal.
2. We are certain in our own mind that the needle was not in the canal as too much force was required to make the injection.
3. Seven minutes after injection, cramps of the front legs set in. These disappeared four minutes later. It was suggested that it was a reflex action. (Have noticed it several times since and now ascribe at least part of it to efforts of the dog to brace itself and thus counteract the lack of muscle tone in the hind quarters.)
4. Anal sphincter relaxed. Muscle tone of hind quarters absent. Sensibility of skin and mucous membranes of rectum and vagina lost.
5. Same as 4.
6. Anal sphincter did not relax. Retention of some muscle tone. Sensibility of skin lost.
7. Anal sphincter did not relax. Retention of some muscle tone, some coördination, and sensibility of penis.
8. Tetanic cramps of both hind legs set in 5 minutes after injection. They lasted until 20 minutes after injection. Anal sphincter relaxed to good degree. Sensibility of skin gone.
9. Dullness of the eyes and a somewhat listless attitude characterized the subject during the anesthesia. Anal sphincter partially relaxed, sensibility of skin gone, a little muscle tone of hind legs. Six hours after injection: lack of appetite, listlessness in general, and a slight stiffness of the hind legs. May be involvement of medulla oblongata.
10. There was an excellent muscular anesthesia of the region for a few minutes, then it began to return towards normal. However, the sensory anesthesia was excellent for 20 minutes.
11. Muscle tone of hind legs retained. Anal sphincter relaxed. Sensibility of skin lost to a great degree.
12. There is no doubt but that the solution was injected into the canal but the ratio is too large.
13. Sensibility of skin completely lost but some muscle tone of hind legs and tail retained. Some sensibility of penis also retained. Anal sphincter not relaxed.
14. Anal sphincter relaxed. Muscle tone of hind legs present to some degree. Sensibility of skin lost.
15. In test 14 also on anesthesia. A very strong and active dog.
16. Anal sphincter partially relaxed. Muscle tone present in hind legs and tail. Sensibility of skin, vagina and rectum lost.
17. Anal sphincter relaxed. Complete relaxation of muscles of hind quarters. Sensibility of skin, rectum and vagina lost. Spasmodic cramps of front legs. Compare results of tests 13, 14, 16, 17, 18 and 19. So far the subject weighing 27.5 kg. seems to have a stronger resistance to tutocaine than the one weighing 25.7 kg.
18. Anal sphincter relaxed. Some muscle tone present in hind legs. Sensibility of skin completely gone but a little sensibility of mucous membranes of rectum and vagina. This test lasted a little longer than usual.

19. As we had had no results with this dog in the morning, we decided to make another injection in the afternoon. Five cc was injected rapidly. Immediately, and before more could be injected, violent convulsions of the whole body set in. They lasted 10 or 15 seconds, then anesthesia began to set in. Have seen this happen a few times before when injection was made too rapidly. There was also involuntary urination in great quantities.

20. Noticed only slight unsteadiness in hind legs and dog could not wag its tail quite so well as normally. There is a possibility that all of the solution was not injected into the canal as the dog moved a few times and several adjustments of the needle had to be made.

21. Anal sphincter relaxed. Involuntary urination. Sensibility of skin and of the rectal and vaginal mucous membranes lost. Some muscle tone of the hind legs retained. Could be classed as excellent except for that.

22 At the 3½-minute interval (table I) only a good anesthesia was present. The excellent anesthesia did not set in until 6 minutes after injection. Blurriness of the eyes and abnormal lacrimation (see test 11 and note 9). Anal sphincter relaxed. Muscle tone and sensibility of skin and vaginal and rectal mucous membranes lost.

23. Anal sphincter relaxed. Sensibility of skin and mucous membranes of rectum and vagina lost. Some muscle tone present. Involuntary urination (this occurs only in this subject).

24. Tests 27, 28, 29, 30, 31 and 32 are being made at the conclusion of experiments with 1 per cent solution to make a final test of the 1 cc-2 kg. theory.

25. Convulsions during injection. Injection stopped immediately. Convulsions lasted four or five seconds, then anesthesia began to set in. Took 12 minutes for anesthesia to develop. Anal sphincter relaxed. Sensibility of skin and mucous membranes of rectum and vagina lost. Muscle tone gone, though cramps of the hind legs set in for a few minutes after the convulsions. Solution was injected quickly but not so rapidly as in test 22. In test 27 we believe that the solution was injected just as rapidly as in this case. However, this subject (25.7 kg.) always has impressed us as being more sensitive to the effects of tutocaine than the other dog (27.5 kg.). Frank recommends the injection of barbitol solution in these cases of convulsions. But in the few cases that we have seen, the convulsions did not last long enough to afford the operator time to make one of these injections, and we have never seen a fatal result though Frank intimates that they do occur.

26. No results in test 27, which was attempted 1½ hours previously, so decided to give another injection. Result may be interpreted as due to some of former solution being present and augmenting this injection.

27. Anesthesia of tail. Medium anesthesia of skin only. Test 20 also had the same result.

28. Relaxation of the anal sphincter. Loss of sensibility of skin. No muscle tone. See tests 23 and 29.

29. Considerable doubt if the solution was injected into the canal, as subject refused to remain quiet.

In order to summarize these tests we divide the tests into five groups, using the ratio of the number of cubic centimeters injected to the kilograms of body weight as a basis. These groups are: 1:1.40 to 1:1.80, 1:1.81 to 1:2.20, 1:2.21 to 1:2.60, 1:2.61 to 1:3.50 and 1:3.51 and over. This arrangement divides it fairly evenly, taking into consideration the number of tests going into each group and the spread of the ratio.

Group I (1:1.40 to 1:1.80): 5 tests (10, 11, 24, 25, 26).

Range of time to take effect: 1½ to 4 minutes. *Average:* 2.8 min.

Range of duration: 25 to 30 minutes. *Average:* 26 min.

Range of quality: good to excellent. *Average:* 3.2 or good. (Excellent is accorded 4 points; good, 3 points; medium, 2 points; poor, 1 point; none, zero. In other words, this group is fairly reliable, only there is a tendency for symptoms of cerebral involvement (tests 11 and 25) which might lead to embarrassment if used extensively.

Group II (1:1.81 to 1:2.20): 11 tests (6, 7, 15, 20, 21, 23, 27, 29, 30, 31, 32).

Range of time to take effect: 2 to 5 minutes. *Average:* 2.59 min.

Range of duration: 17 to 35 minutes. *Average*: 18.81 min.

Range of quality: none to excellent. *Average:* 2.09 or medium. This group is not very reliable, producing excellent results one time and nothing the next. The ratio, though, has impressed us as being right, as there is sufficient quantity here to reach all the nerves effectively and yet not involve the brain. Frank uses 1 cc to 5 pounds, which is about the same.

Group III (1:2.21 to 1:2.60): 6 tests (1, 2, 3, 5, 12, 18).

Range of time to take effect: 0 to 15 minutes. *Average:* 4.16 min.

Range of duration: 0 to 27 minutes. *Average:* 16.16 min.

Range of quality: none to excellent. *Average:* 1.66 (poor to medium). This is more variable than any so far.

Group IV (1:2.61 to 1:3.50): 5 tests (4, 16, 17, 19, 28—though perhaps test 28 should not be included as it was entirely abnormal).

Range of time to take effect: 0 to 12 minutes. *Average:* 5 min.

Range of duration: 0 to 50 minutes. *Average:* 29.4 min.

Range of quality: none to excellent. *Average:* 2.6 (medium to good).

Excluding test 28 we have the following:

Range of time to take effect: 0 to 6 minutes. *Average:* 3.25 min.

Range of duration: 0 to 50 minutes. *Average:* 26.75 min.

Range of quality: none to excellent. *Average:* 2.25 (little better than medium).

Group V (1:3.51 and over): 5 tests (8, 9, 13, 14, 22; also convulsions in test 22).

Range of time to take effect: 0 to 8 minutes. *Average:* 3.3 min.

Range of duration: 0 to 35 minutes. *Average:* 20 min.

TABLE II

TEST	DATE	AGE	WEIGHT (KILO)	AMOUNT INJ. (CC)	RATIO	ANESTHESIA			AFTER-EFFECTS			NOTE
						TOOK EFFECT (MINS.)	DURATION (MINS.)	QUALITY	6 HRS.	1 DAY	2 DAYS	
33	3–23	O	27.5	5.0	1:5.5	3	30	Poor	—	—	—	30
34	3–23	O	25.7	5.0	1:5.14			None	—	—	—	31
35	3–25	O	27.5	7.5	1:3.66	4	30	Med.	—	—	—	32
36	3–25	O	25.7	5.0	1:5.14	1	70	Exc.	—	—	—	33
37	3–25	Y	7.4	2.5	1:2.96	3	20	Exc.	—	—	—	34
38	3–27	O	27.5	10.0	1:2.75	4	30	Good	—	—	—	35
39	3–30	O	27.5	12.5	1:2.20	4	30	Good	—	—	—	36
40	4–1	O	27.5	15.0	1:1.83	5	43	Exc.	—	—	—	37
41	4–3	O	27.5	14.0	1:1.96	4½	33	Exc.	—	—	—	38
42	4–6	O	27.5	14.0	1:1.96	3	40	Exc.	—	—	—	39
43	4–9	O	27.5	14.0	1:1.96	6	85	Exc.	—	—	—	40
*44	4–16	A	9.5	5.0	1:1.90	?	?	Exc.	—	—	—	41
*45	4–16	O	11.5	5.0	1:2.30	?	?	Exc.	—	—	—	42
46	4–17	O	13.0	5.0	1:2.60	2½	30	Poor	—	—	—	43
*47	4–18	A	21.5	10.0	1:2.15	?	?	Exc.	—	—	—	44
*48	4–20	O	15.5	5.0	1:3.00	?	?	Exc.	—	—	—	45
49	4–22	O	13.0	5.0	1:2.60	3	75	Exc.	—	—	—	46
*50	4–24	O	27.5	14.0	1:1.96	?	?	Exc.	—	—	—	47
*51	4–24	O	31.0	10.0	1:3.10	?	?	Exc.	—	—	—	48

Y = Young.
A = Adult.
O = Old.
* = Operative case.

Med. = Medium
Exc. = Excellent

Range of quality: none to excellent. *Average:* 1.8 (almost medium).

With test 22 excluded:

Range of time to take effect: 0 to 8 minutes. *Average:* 3.37 *min.*

Range of duration: 0 to 25 minutes. *Average:* 16.25 min.

Range of quality: none to medium. *Average:* 1.25 (poor).

On comparing the results of this summary and on perusal of table I it will be seen that the effects of the 1 per cent solution are variable to such a degree that we thought it was useless to continue work with it.

Notes on Table II

30. Anesthesia of tail. Relaxed anal sphincter. Only unsteadiness of hind legs. Sensibility of skin and mucous membranes of rectum and vagina present though not to the normal degree.

31. Considerable doubt if the solution was injected into the canal, as the author had to make the injection unassisted, which is difficult. Required some force to operate the syringe.

32. Anal sphincter relaxed. Able to keep hind legs under itself but very wobbly, frequently going down. Perhaps a little sensibility of skin and mucous membranes of rectum and vagina.

33. Anal sphincter relaxed. Complete loss of muscle tone and sensibility. Involuntary urination. Subject seems to be developing an abnormal sensibility to tutocaine, as this set in as a shock (not a convulsion, though) instead of a normal, progressive anesthesia. Solution was injected slowly. This subject had convulsions in tests 22 and 28. She has had 11 injections.

34. Complete loss of muscle tone and sensibility of skin. Anal sphincter relaxed. Vomited two minutes after injection. After next injection, was discarded for abnormal sensibility. Perhaps this was only another evidence of that.

35. Anal sphincter relaxed. Sensibility of both skin and mucous membranes gone. Some muscle tone of hind legs.

36. Anal sphincter relaxed. Lost sensibility of skin and mucous membranes of rectum and vagina. Only a little muscle tone of hind legs. This percentage in this subject has given uniform and progressively good results (see tests 33, 35, 38 and 39). On March 27, the subject weighing 7.4 kilograms gave evidence of having developed an abnormal sensibility to tutocaine. When the injection was started he became excited and struggled to such an extent that the needle was forced out of the body. Only a very small but unknown amount (probably about ½ cc) was injected. However, perfect anesthesia followed immediately. This was so abnormal that it was not recorded. He has had 9 injections.

37. Anal sphincter relaxed. Sensibility of skin and mucous membranes of rectum and vagina lost. Perhaps a slight muscle tone of the hind legs. Could notice a slight dullness of the eyes.

38. Same as note 37, except there was no involvement of the eyes.

39. A very slight muscle tone of the hind legs. Anal sphincter relaxed. Complete loss of sensibility of skin and the mucous membranes of the region. This 3 per cent solution seems to produce no better results than the 2 per cent solution.

40. Only good anesthesia in 3 minutes; 3 minutes later, excellent anesthesia started. Anal sphincter relaxed. No muscle tone of the hind quarters. Complete loss of sensibility of skin and mucous membrane of rectum and vagina. Tried addition of adrenalin hydrochlorid (1:1000) solution as recommended by Frank to increase length of duration of the anesthesia. He advises 8 drops of 1:1000 adrenalin hydrochlorid to 100 cc of the anesthesic solution. We added 5 drops to 25 cc. The great increase in duration recorded may be due to

this or the fact that the subject is developing an abnormal sensibility. See test 36, in which a duration of 70 minutes is recorded, but the dog was discarded a few days later as it became evident that an abnormal sensibility was present. This dog (test 43) has had 17 injections.

41. Operative case. Black French bulldog (female) weighing 9.5 kg. Dystokia. Immediately after the injection, the dog was placed on the operating-table in lateral recumbency with the head slightly lower than the tail. Three and one-half minutes later, the operation (cesarean section) was started through the right flank. Incision carried through skin, fascia, muscle and peritoneum. Uterus incised, pups delivered, incisions in uterus and abdominal wall sutured, and pack sutured in place over incision. Operation lasted 19 minutes. At no time was there any evidence of pain and at the end of the operation the patient still had complete relaxation of the hind quarters. Did not deem it wise to bother the patient to determine the length of the anesthesia. One hour and fifteen minutes later the motor functions of the hind quarters had returned to a great degree.

42. Operative case. Ten-year-old mongrel bitch, weighing 11.5 kg. Pyometra. Was fat, so did not give as much as the ratio would indicate (*i.e.* 6 cc). Immediately after the injection the patient was placed on the operating-table in dorsal recumbency with head slightly lower than tail. Five minutes after the injection, an incision was made on the linea alba through the skin, fascia, muscles, and peritoneum. Ligations made, uterus excised, stump of uterus and incision in abdominal wall sutured. Operation lasted 18½ minutes. At no time was there any evidence of pain. Still complete relaxation of hind quarters existing at the end of the operation. One and one-half hours after the operation, the patient appeared to be normal as far as the anesthesia was concerned. One day after operation, had a temperature of 36.1° C. (May be due to operation.) Two days after the operation, the temperature was returning towards normal. It was 37.3° C. Patient made complete recovery.

43. Only anesthesia of tail was present. The dog completely changed position once during the injection and all of the solution may not have been injected into the canal.

44. Operative case. Six-year-old, female, Doberman mongrel. Pyometra. Weighed 21.5 kg. Immediately after the injection, the patient was placed on the operating-table in dorsal recumbency. Five and one-half minutes later, an incision was made on the linea alba through the skin, fascia, muscle and peritoneum. Ligations made, uterus excised, stump of uterus and incision through abdominal wall sutured. Operation lasted 22 minutes. At no time was there any evidence of pain. Cramps of the muscles of the fore quarters and neck noticed.

45. Operative case. Ten-year-old, white and yellow female mongrel. Pyometra. Weighed 15 kg. but fat (normal weight would have been about 10 kg. so injected only 5 cc). Immediately after the injection, the patient was placed on the operating-table in dorsal recumbency. Four minutes later, an incision on the linea alba was made through the skin, fascia, muscles, and peritoneum. Ligations made, uterus excised. Stump of uterus and incision through abdominal wall sutured. Time elapsed between making the incision in the skin and tying the last suture in the skin was 21 minutes. At no time was there any evidence of pain. Noticed stiffness of left front leg during operation. One hour and 10 minutes later, the dog appeared to be back to normal sensibility. The amount of fat very obviously does not increase the size of the spinal canal or the number of nerves to be anesthetized so we gave only the number of cubic centimeters that would be correct for what we considered the normal weight.

46. Relaxation of anal sphincter. Complete loss of sensibility of skin and penis. Had added 4 drops of 1:1000 adrenalin hydrochlorid solution to 25 cc of tutocaine solution.

47. Operative case. Old, yellow, female mongrel, weighing 27.5 kg. Had been an experiment dog. Spay case. This was the 18th injection for her. Immediately after the injection, she was placed on the operating-table in dorsal recumbency. Incision through the abdominal wall was made 3½ minutes later. Four and one-half minutes after the injection, one horn of the uterus was picked up; very slight evidence of pain. One and one-half minutes

later, the other horn was picked up. Still some slight pain though not enough to cause a whimper or moan. Seemed to be more of a dull, mechanical-like sensation. Ligations made, uterus excised, incision in abdominal wall sutured. Operation lasted 16½ minutes.

48. Operative case. Nine-year-old German Shepherd bitch, weighing 31 kg. Pyometra. Weak pulse and weak physical condition. Excessively fat but would have a normal weight of about 30 kg. During the injection, the patient made one or two abortive attempts to vomit. Immediately after the injection she was placed on the operating-table in dorsal recumbency with the head slightly lower than the tail. Six minutes after the injection, an incision was made in the abdominal wall. Ligations made, uterus excised, stump of uterus and incision in abdominal wall sutured. Operation lasted 24½ minutes. At no time was there any evidence of pain, with one exception. As one of the stitches was being taken in the peritoneum, there was a slight movement of that part of the body. It was on the same order as those movements noted in test 50.

Ten minutes after the operation the patient died. Opinion is divided as to whether the causative factor was surgical shock and heart failure or a complication arising from the anesthesia or anesthetic.

These tests will be considered under three headings: the tests as a whole; the purely experimental tests; and the operative cases.

In considering the tests as a whole we find that there were 19 tests employing the 2 per cent solution, but as some where operative cases and two were made with adrenalin hydrochlorid added to the solution it is very difficult to rank them as was done with the 1 per cent solution tests. In all fairness it is probably best to state that in one experiment we tried several times to make an injection but were never able to locate the lumbo-sacral space with the needle. Perhaps these should have been entered on the chart and classified as no anesthesia.

We divide the tests into the following groups:

Group I (1:1.80 to 1-2.20): 8 tests (39, 40, 41, 42, 43, 44, 47, 50).

Range of quality: good to excellent. *Average:* 3.87 (almost excellent).

Group II (1:2.21 to 1:2.60): 3 tests (45, 46, 49).

Range of quality: poor to excellent. *Average*: 3 (good).

Group III (1:2.61 to 1:3.10): 4 tests (37, 38, 48, 51).

Range of quality: good to excellent. *Average:* 3.75 (nearly excellent).

Group IV (1:3.11 and over): 4 tests (33, 34, 35, 36).

Range of quality: poor to excellent. *Average:* 1.75 (nearly medium).

In dealing with the purely experimental cases we can treat them as the 1 per cent solution tests were treated. They are grouped as follows (tests 43 and 49 are excluded, as adrenalin hydrochlorid solution was employed in them):

Group I (1:1.80 to 1:2.20): 4 tests (39, 40, 41, 42).

Range of time to take effect: 3 to 5 minutes. *Average:* 4.12 min.

Range of duration: 30 to 43 minutes. *Average:* 36.5 min.

Range of quality: good to excellent. *Average:* 3.75 (almost excellent).

Group II (1:2.21 to 1:2.75): 2 tests (38 and 46).

Range of time to take effect: 2½ to 4 minutes. *Average:* 3.25 min.

Range of duration: 30 minutes. *Average:* 30 min.

Range of quality: poor to good. *Average:* 2.00 (medium).

Group III (1:2.76 and over): 5 tests (33, 34, 35, 36, 37).

Range of time to take effect: 0 to 4 minutes. *Average:* 2.2 min.

Range of duration: 9 to 70 minutes. *Average:* 30 min.

Range of quality: none to excellent. *Average:* 2.2 (little better than medium).

(See notes 33 and 34.)

It can be noticed here that once more the ratio of 1 cc of anesthetic solution to 2 kilograms of body weight tends to produce the most uniform and best results. Frank records that procaine needs about 10 minutes to produce anesthesia and that it affects for 1 to 1½ hours. Tutocaine needs only 4 minutes to cause anesthesia but the first sign of return towards normal sensibility is 35 or 40 minutes, though we believe that suturing of the skin and other such external manipulations could be performed for several minutes longer and produce no pain.

When the operative cases are reviewed we can draw conclusions only from the results. In no case has there been noticed a tendency to strain and force internal organs out through the incision in the abdominal wall as is so common under local anesthesia. As mentioned in the notes, in only two cases was there any evidence whatsoever of any sensation of the region during an operation, and these two cases were not sharp pains but more on the order of a dull cognizance of the fact that the posterior regions of the body were being handled. The incisions in the skin were made 3½, 4, 4½, 5, 5½ and 6 minutes after injection. Operations lasted 16½, 18½, 19, 21, 22 and 24 minutes. The quality was consistently excellent.

There were two other operative cases in which lumbar anesthesia was employed but the author was not present and conse-

quently has no notes on them. However, excellent results were reported.

With the exception of the death in test 51 and the sensibility which developed in experiment dogs there have been no unfavorable sequelae noticed.

The element of time entered into these experiments and drew them to a close somewhat in advance of what we would have liked.

Conclusions

1. Lumbar anesthesia in the dog is possible and from all indications practical, if:

(a) One is careful in the selection of the site of insertion, the insertion of the needle, the amount of solution injected, and the rapidity of injection.

(b) The inexperienced operator will have patience and realize that he must learn to make the injection properly. He should make the first five or six injections in fairly large, phlegmatic dogs. One or two dissections of the region on dead dogs are of great value.

2. One per cent tutocaine in physiological saline solution in safe amounts is too variable to be recommended.

3. Two per cent tutocaine in physiological saline solution is very reliable in producing anesthesia if used in about the ratio of 1 cc of the solution to 2 kg. of body weight.

4. Tutocaine seems to induce anesthesia somewhat more rapidly than procaine, but the procaine anesthesia is of longer duration.

5. The addition of a few drops of 1:1000 adrenalin hydrochlorid solution to 100 cc of tutocaine solution, as recommended by Frank, perhaps lengthens the period of anesthesia for something like 30 minutes.

Acknowledgments

There is a great indebtedness on our part to Drs. Frank and McLeod, as very frequently in the above article we have merely used our own words to restate their ideas and redraw their conclusions.

Also, we extend out thanks to Dr. Pommer and his staff in the Röntgen Institut for their willingness to help and to Prof. Dr. Krölling and Dozent Dr. Bauman for their permission to study skeletons and make dissections of the lumbar region in dogs.

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INVESTIGATIONS ON THE PASSIVE IMMUNIZATION OF SMALL ANIMALS IN VESICULAR STOMATITIS*

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In vesicular stomatitis as well as in foot-and-mouth disease the discovery of the transmission of the virus to guinea pigs opened a much greater field of experimental possibilities than had before existed. Among the numerous scientific problems, which have been investigated by means of guinea-pig experiments, immunity studies of the two very similar viruses assume a most important place. Thus guinea-pig experimentation is the basis of a standardized serum test utilizing technic of passive immunization (Waldmann and Pape[11]). Likewise the test of the actively acquired immunity of guinea pigs is the basis of the plurality virus research, which has become a special subject within the past few years (Waldmann and Trautwein,[12] Trautwein[5]). Soon after the successful transmission of vesicular stomatitis virus to guinea pigs by Cotton,[1] as well as by Olitsky, Traum and Schoening,[3,4] attempts were made to utilize the experimental results of foot-and-mouth disease research with the special aim to establishing, if possible, means of differentiating the two diseases. In this way the duality of the vesicular stomatitis virus (Indiana and New Jersey strains) was established by Cotton.[2] Olitsky, Traum and Schoening[4] found that also in vesicular stomatitis a serum standardization by means of passive immunization methods in guinea pigs is possible in the same way as in foot-and-mouth disease. The immune or convalescent serum collected from recovered animals protects only against vesicular stomatitis but not against foot-and-mouth disease. So it seemed at first that the distinction between foot-and mouth disease and vesicular stomatitis could be established by the cross-immunity test, but soon after, when the duality of the vesicular stomatitis virus was discovered by Cotton,[2] new difficulties arose against this possibility. Cotton[2] stated that by guinea-pig experimentation the hoped-for distinction between vesicular stomatitis and foot-and-mouth disease was not realized.

From the vesicular stomatitis infection in guinea pigs exactly described by Cotton,[1] as well as Olitsky, Traum and Schoening,[3,4]

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a lower virulence of the vesicular stomatitis virus compared with the foot-and-mouth disease virus is to be expected, because the period of incubation in the former is longer and the generalization regularly found in foot-and-mouth disease is much less common in vesicular stomatitis of guinea pigs. In the writer's own investigations on the effect of different kinds of inoculation and the immunity so obtained, the proof of the lower virulence of the vesicular stomatitis virus in contrast with the foot-and-mouth disease was demonstrated.[9] The results of these investigations were, that the vesicular stomatitis virus, owing to its lower virulence, is able to produce in most of the different kinds of inoculation, an active immunity, without any visible lesions, which is strong enough to protect against a reinoculation with the same virus strain even if it is injected into susceptible tissue. Though this significant difference between the virus of foot-and-mouth disease and vesicular stomatitis has thus been established, it is not yet practical for differential diagnosis purposes. On the other hand, the experimental proof of the lower virulence of the vesicular stomatitis virus led the writer to an investigation of passive immunization possibilities, in order to find out whether the relatively slight active immunization with living virus corresponds to the same or similar passive immunizing processes. The special experiments made in this direction are here described.

First Test on Guinea Pigs

Passive immunizing experiments were made at first with guinea pigs and thereafter also with white rats. For obtaining an immune serum guinea pigs were killed and totally bled on the average of four to five weeks after complete recovery and healing from the vesicular stomatitis infection. The collected serum was preserved by adding 0.5 per cent phenol. In the first preliminary trials this serum was injected in different doses subcutaneously on the abdomen or into the subcutaneous tissue of one or both hind pads. In the latter case as much serum was injected as the pad would take up. Twenty-four hours after the serum injection, the guinea pigs were inoculated cutaneously by scarification on one hind pad and then examined daily over a period of about three weeks for symptoms of vesicular stomatitis. After this period they were reinoculated, at first with the homologous virus strain and later on in some cases also with the heterologous virus strain.

The results of the first preliminary test are shown in table I. The experiment shows that one out of four guinea pigs, each

TABLE I—*Results of experiment to show that guinea pigs treated with immune serum are protected against a cutaneous inoculation of virus made 24 hours later.*

DAY	G. P. 1	G.P. 2	G. P. 3	G. P. 4	G. P. 5	G. P. 6	G. P. 7	G. P. 8	G. P. 9
1	2 cc of guinea-pig immune serum subcutaneously on the abdomen				Guinea-pig immune serum subcutaneously, left hind pad				Virus control
2	Cutaneous inoculation, left hind pad				Cutaneous inoculation, left hind pad		Cutaneous inoculation, both hind pads		Indiana strain
4	−	−	−	−	−	−	−	−	+
5	−	−	−	−	−	−	−	+	
8	−	−	−	−	−	−	−		
10	−	−	−	−	−	−	+		
14	−	−	+ +	−	−	−			
15	−	+ +		−	−	−			
16	−			+ +	−	−			
20	−				−	−			
24	−				−	−			
25	Cutaneous reinoculation both hind pads (Indiana strain)								
27	+	−	−	−	−	−	−	−	−
30		−	−	−	−	−	−	−	−

− = No visible lesions.
\+ = Primary lesions.
\+ + = Secondary lesions.

treated with 2 cc of immune serum, was completely protected against a cutaneous inoculation made 24 hours later. The animals were examined for a period of 25 days following the serum injection. The three other guinea pigs showed lesions on the fourteenth, fifteenth and sixteenth days after the inoculation, having shown no clinical symptoms at all until that time. It is noteworthy that none of these animals developed lesions at the site of inoculation but secondary lesions appeared on one of the other susceptible places. Therefore, it must be concluded that the virus can persist alive in the guinea-pig body not only at the site of inoculation but throughout the body, and may develop its infectious power again after the serum effect has passed. Two out of four guinea pigs, that had been treated locally on the left hind pad, came down within the 25-day period of examination; they were inoculated 24 hours after the serum injection on both hind pads. One of them yielded lesions as early as the fifth day, but the other not until the tenth day after the inoculation. In both cases the infection was local and confined to one of the inoculated pads. The other two guinea pigs which also had been treated locally with serum but inoculated only on the treated pad, did not show any lesions within the examination period. By the reinoculation with the homologous virus strain, 25 days after the previous treatment, all guinea pigs proved to be immune except one (No. 1) that had shown no lesions after the previous treatment.

The conclusion appears to be warranted from this first experiment that the guinea pig can be completely protected, if only temporarily, by a (homologous) guinea-pig immune serum injected subcutaneously on the abdomen or locally at the site of a cutaneous inoculation of living virus made 24 hours later on one metatarsal pad.

This fact, which established a striking difference from foot-and-mouth disease, in which case the guinea pig even by the largest serum dose at best can be protected against the generalization but by no means against the local primary infection, demanded further investigations on the duration and quantitative conditions of the passive immunizing possibilities of guinea pigs in vesicular stomatitis.

Serum Injected Six Hours Before Virus

At first the influence of the time of the serum injection and the inoculation in their relation to the protective effect of the serum

TABLE II—*Results of experiment to show that guinea pigs treated with immune serum are protected against a cutaneous inoculation of virus made 6 hours later.*

DAY	G. P. 1	G. P. 2	G. P. 3	G. P. 4	G. P. 5	G. P. 6	G. P. 7	G. P. 8	G. P. 9	G. P. 10	G. P. 11
1	Immune serum					Normal serum					Control
10 a. m.	0.2 cc	0.5 cc	1.0 cc	2.0 cc	3.0 cc	0.2 cc	0.5 cc	1.0 cc	2.0 cc	3.0 cc	
4 p. m.	Cutaneous inoculation, left hind pad (Indiana strain)										
3	−	−	−	−	−	−	−	−	−	−	+
4	−	−	−	−	−	+	+	+	−	+	+ +
7	−	−	+	−	−				−		
12	−	−		−	−				−		
20	−	−		−	−				−		
22	Cutaneous reinoculation, both hind pads (Indiana strain)										
24	+	−	−	+	+	−	−	−	+	−	−

− = No visible lesions.
\+ = Primary lesions.
\+ + = Secondary lesions.

had to be proved. While in the usual technic of serum tests in foot-and-mouth disease, serum injection and inoculation are simultaneous, in the first trial, just described, the serum was injected 24 hours before the cutaneous inoculation. In the next test this period was reduced to 6 hours and the serum was injected subcutaneously only on the abdomen, not locally on the pad. The same serum was used and, for comparison, also normal serum.

The results of these experiments, as shown in table II, demonstrate that, even by serum injections 6 hours before the inoculation, it is possible to protect guinea pigs by 2 cc of an immune serum against the primary infection. During the examination period of 22 days, only that guinea pig treated with 1 cc of serum yielded primary lesions and then not until the seventh day after the inoculation. In contrast with the immune serum, the normal serum did not develop any protective effect under the same conditions. Only one guinea pig treated with 1 cc did not come down. This case was unique also among the later experiments.

After the reinoculation, which was made 22 days after the treatment with serum and virus, all guinea pigs with the exception of one (No. 2) having shown no lesions after the treatment proved not to be immune. The guinea pigs which showed lesions after the treatment were immune, as was to be expected.

Specificity of Serum Tested

In a third experiment the specificity of the serum effect was to be proved by using an immune serum of the Indiana strain against an infection with the New Jersey strain. The simultaneous technic was used.

As shown in table III, no protection was produced by the same serum as used in the first two tests even with the largest amount of serum. Results were the same with normal serum. The passive immunity proved also to be specific, as is the case in foot-and-mouth disease (Trautwein,[5] Olitsky, Traum and Schoening,[4] Trautwein and Reppin.[7]

In a fourth experiment the local protective effect of guinea-pig convalescent serum compared with guinea-pig normal serum was tested again. The pads of the guinea pigs were injected subcutaneously with as much serum as they could take up (about 1 cc) and 6 hours later were inoculated cutaneously, both on the treated and untreated pads. A complete protection against the vesicular stomatitis infection was produced by the immune serum for the 24 days during which observations were made.

TABLE III—*Results of experiment to show that guinea pigs treated with immune serum (Indiana strain) are not protected against an injection of a heterologous (New Jersey) strain of virus.*

DAY	G. P. 1	G. P. 2	G. P. 3	G. P. 4	G. P. 5	G. P. 6	G. P. 7
	Immune serum (Indiana strain)				Normal serum		Control
1	0.2 cc	0.5 cc	1.0 cc	2.0 cc	1.0 cc	2.0 cc	
	Cutaneous inoculation, left hind pad (New Jersey strain)						
3	+	+	+	+	+	+	+
22	Cutaneous inoculation, both hind pads (New Jersey strain)						
27	−	−	−	−	−	−	−

− = No lesions.
+ = Primary lesions.

while the control guinea pigs treated with normal serum came down after an incubation period of 3 or 4 days.

On reinoculation with the homologous virus strain the unaffected guinea pigs which had been treated with immune serum proved to be not immune. This is in accord with results of a former experiment.

The fifth experiment was to prove the influence of the serum dose and the time of serum injection in relation to passive immunization. For this purpose guinea pigs were treated simultaneously and 24 hours before infection with 0.5 and 2.5 cc of immune serum and, as controls, other guinea pigs were treated with the same amounts of normal serum.

The results as recorded in table V demonstrate that the normal serum did not protect with either of the two doses, while the immune serum simultaneously injected produced a complete protection with the dose of 2.5 cc during the period of 18 days.

Two-tenths of a cubic centimeter of serum, injected 24 hours before inoculation, produced a protection for 5 days, and the dose of 2.5 cc a complete protection during 18 days. When reinoculated 18 days after the previous treatment, the two guinea pigs treated with 2.5 cc of immune serum without yielding lesions, proved to be not immune, while all other guinea pigs were immune.

Serum Dose and Duration of Passive Immunity

In the sixth experiment the influence of the serum dose on the duration of the passive immunity was tested. Serum doses of 0.2, 0.5, 1.0 and 2.5 cc of guinea-pig convalescent serum injected simultaneously with, and 1 to 15 days before, the usual cutaneous inoculation. Normal serum was used as a control. It was injected simultaneously and also 1 to 12 days before the inoculation. The results are recorded in table IV.

The amount of 0.2 cc of serum protected only when injected 24 hours before the inoculation, while the simultaneously treated guinea pigs and all those which were inoculated later than 24 hours after the serum injection were not protected. It was the same with the dose of 0.5 cc. With 1.5 cc of serum injected simultaneously and also when the inoculation was made two and four days after the serum injection, a complete protection was established, but the protection was unreliable 7 and 9 days and entirely lacking 15 days after the serum injection. Two and five-tenths cubic centimeters of serum simultaneously injected

TABLE IV—*Results of experiment to show the duration of the passive immunity conferred by immune serum. (All serum injections made subcutaneously.)*

G. P.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
DAY	Immune serum																								Normal serum					
1	0.2 cc						0.5 cc						1.0 cc						2.5 cc						1.5 cc					
1	I						I						I						I						I					
2	−	I					−	I					−	I					−	I					−	I				
3	+	−					+	−					−	−					−	−					+	−				
4		−	I					−	I				−	−	I					−	I					−	I			
7		−	+	I				−	−	I			−	−	−	I			+	−	−	I				+	+		I		
9		−		+	I			−	+	+	I		−	−	−	+	I			−	−	−					+		+	I	
10		−			?			−			−		−	−	−		−			−	−	−	I						−		
11		−			+			−			−		−	−	−		−			−	−	−	−						+		
13		−				I		−			−	I	−	−	−		−			−	−	−	−			+	+			I	
14		−				?		−			−	−	−	−	−		−			−	−	−	−	I						−	
15		−				+		−			+	+	−	−	−		−	I		−	−	−	−	−						+	
17																		+		−	−	−	−	−							
22						+ +																		+							
27	Cutaneous reinoculation, both hind pads																													
29	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−

I = Cutaneously inoculated, left hind pad.
− = No visible lesions.
\+ = Primary lesions.
\+ + = Secondary lesions.

only prolonged the incubation period but did not confer complete immunity. This dose protected the guinea pigs against the cutaneous inoculation from 1 to 10 days after the serum injection. When the inoculation was made 14 days after the serum injection, the incubation period was only prolonged to 8 days, after which the guinea pigs showed primary lesions. In contrast with the immune serum, the normal serum did not protect against any of the various inoculations. Only when injected 24 hours before the inoculation did the normal serum prolong the incubation period to 11 days; then the guinea pigs developed a generalized infection. Six weeks after the beginning of this experiment all guinea pigs were reinoculated cutaneously on both hind pads. Even those guinea pigs proved to be immune which had shown no visible lesions after the first treatment.

It was shown by this experiment that a specific protection can be produced by 0.2 cc of a homologous immune serum against the vesicular stomatitis of guinea pigs. This protection is most reliable when the guinea pigs are inoculated 24 hours after the serum injection, while the protection becomes uncertain when the guinea pigs are inoculated simultaneously or at any time later than 24 hours after the serum injection. In these cases the protection can be established only by much larger doses of serum.

Futher Serum-Protection Tests

Now, it remained to test by further experiments whether the same protection can also be produced in guinea pigs by heterologous, immune or convalescent sera. For this purpose the sera of horses, cattle, rats, rabbits and pigeons, which had been inoculated or treated with virus, were tried.

Experiments with white rats: After the white rat had been found to be susceptible to the vesicular stomatitis virus and useful for experimental work (Wagener) the passive immunity test also could be tried.

On white rats the effect of a homologous convalescent serum was tested by the same technic as in the guinea-pig experiments, already described. The convalescent serum of white rats was tested also in guinea pigs.

In the first experiment a rat convalescent serum was tested in rats, using for the inoculation the homologous virus strain. The serum was injected in different doses 24 hours before the rats were inoculated on one metatarsal pad. For comparison normal rat serum also was used. The results, as recorded in table V,

TABLE V—*Results of experiment to show that normal serum does not protect, while immune serum injected simultaneously does protect rats against an injection of homologous virus.*

DAY	R. 1	R. 2	R. 3	R. 4	R. 5	R. 6	R. 7	R. 8	R. 9	R. 10	R. 11	R. 12	R. 13
1	Rat convalescent serum (Indiana strain)		Rat convalescent serum (New Jersey strain)					Normal serum				Controls	
	0.5 cc	2.0 cc	0.2 cc	0.5 cc	0.7 cc	1.2 cc	2.0 cc	1.0 cc	2.5 cc	1.0 cc	2.5 cc		
2	Cutaneous inoculation, left hind pad (Indiana strain)		Cutaneous inoculation, left hind pad (New Jersey strain)					Cutaneous inoculation, left hind pad (Indiana strain)		Cutaneous inoculation, left hind pad (New Jersey strain)		Inoculation Indiana strain	Inoculation New Jersey strain
3	−	−	+	+	−	−	−	+	+	+	+	+	+
4	−	−			−	−	−						
7	−	−			−	−	−						
20	Cutaneous reinoculation, both hind pads (homologous strain of virus)												
22	+	+	−	−	+	+	+	−	−	−	−	−	−

− = No visible lesions.
+ = Primary lesions.

show that 0.5 cc of the Indiana and 0.7 cc of the New Jersey rat convalescent serum protected against an inoculation with the homologous virus strain while the normal serum used in doses of 1.0 and 2.5 cc did not afford any protection.

After the reinoculation, which was made 20 days after the beginning of the experiment, all those rats which had shown no lesions after the first treatment were not immune. The immunity produced by this treatment proved, therefore, to be quite passive.

In another experiment the passive immunity was tested with both of the two strains and the cross-immune serum, as recorded in table VI. It was demonstrated by this experiment that a complete protection was produced by serum doses of 0.2 and 0.5 cc of immune serum, while the heterologous and normal serum did not afford any protection. Those rats that did not yield lesions by the previous treatment were not immune when reinoculated with the homologous virus 20 days afterwards.

Specificity of Virus Strains Demonstrated

These results prove also that in white rats the specificity of the two virus strains and their immunity can be demonstrated by means of the passive immunity test.

Rat convalescent serum tests in guinea pigs: In addition, the convalescent serum of white rats, which had been infected first with the Indiana and later with the New Jersey strain, was tested in guinea pigs. This experiment, recorded in table VII, shows that guinea pigs also can be protected by a rat convalescent serum against the inoculation with the homologous virus strain. The convalescent serum originating from a double infection contained more antibodies against the Indiana than the New Jersey strain.

Experiments with horse convalescent serum: The serum of a horse, collected 14 days after infection with the Indiana strain, was injected into guinea pigs both simultaneously and 24 hours before the cutaneous inoculation was made with doses of 0.5, 1.5, 3.0 and 5.0 cc.

The results indicate that horse convalescent serum also can protect guinea pigs against the usual cutaneous inoculation. When the serum was injected before the inoculation, 0.5 cc gave complete protection, but strange to say 1.5 and 3.0 cc did not protect but did prolong the period of incubation 9 days, when the guinea pigs showed primary lesions. In the case of 0.5 cc, an active immunity probably was established before the serum

TABLE VI—*Results of experiment to show complete protection produced by homologous immune serum, with no protection afforded by heterologous and normal serum.*

RAT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
DAY	Rat convalescent serum (Indiana strain)*								Rat convalescent serum (New Jersey strain)								Normal Serum				Controls	
1	0.2	0.5	1.0	2.5	0.2	0.5	1.0	2.5	0.2	0.5	1.0	2.5	0.2	0.5	1.0	2.5	1.0	2.5	1.0	2.5		
2	Cutaneous inoculation, left hind pad (Indiana strain)				Cutaneous inoculation, left hind pad (New Jersey strain)				Cutaneous inoculation, left hind pad (New Jersey strain)					Cutaneous inoculation, left hind pad (Indiana strain)			Cutaneous inoculation (Indiana strain)		Cutaneous inoculation (New Jersey strain)		Cutaneous inoculation (Indiana strain)	Cutaneous inoculation (New Jersey strain)
3	−	−	−	−	+	+	+	+	+	−	−	−	+	+	+	+	+	+	+	+	+	+
6	−	−	−	−						−	−	−										
20	Cutaneous reinoculation, both hind pads (homologous strain of virus)																					
22	+	+	+	+	−	−	−	−	−	+	+	+	−	−	−	−	−	−	−	−	−	−

*Amounts of serum expressed in cc.
− = No lesions.
+ = Primary lesions.

protection ceased, as is shown by the result of the reinoculation, where this guinea pig proved to be immune. By the simultaneous method only did the larger doses of 3.0 and 5.0 cc produce a complete protection, while the smaller doses failed. After the reinoculation, the two guinea pigs protected by the previous treatment proved not to be immune, while the other two guinea pigs were immune.

In contrast with these results a serum collected from a horse that had not shown lesions after an artificial inoculation with the Indiana strain failed to protect guinea pigs in doses of 0.5 to 3.0 cc. Also 2.5 cc of a normal horse serum did not protect.

Experiments with cattle convalescent serum: A cattle serum collected 20 days after an artificial infection with the Indiana strain was examined in two series of tests.

In the first series, in which 0.5, 1.0, 2.0 and 3.0 cc of serum were injected 24 hours before the inoculation, the doses larger than 1.0 cc protected, while the guinea pigs treated with 0.5 cc developed lesions. The guinea pigs which had shown no lesions after this treatment proved to be immune, when reinoculated with the Indiana strain 22 days after the previous treatment.

In the second series the effect of the simultaneous method was compared with the results of a serum injection 24 hours before the inoculation. This test shows that 0.5 cc of cattle serum, injected 24 hours before the inoculation, failed to protect, while 1.5 cc of serum protected until the eleventh day after the serum treatment, when the guinea pigs showed a local vesicle, but the dose of 3.0 cc protected completely. When the serum was given simultaneously with the virus, it was found that 2.0 and 5.0 cc afforded complete protection, but that 3.0 cc failed to prevent the development of a very small vesicle at the site of inoculation 11 days afterwards. By reinoculation, made 20 days after the previous treatment, those guinea pigs which had yielded no lesions proved to be immune except the guinea pigs simultaneously treated with 5.0 cc.

Experiments with rabbit serum: Although the writer's attempts to inoculate rabbits artificially with the virus of vesicular stomatitis did not yield uniform results and were successful in only a few cases, an attempt was made to produce an immune serum from rabbits for protection purposes in guinea pigs. Four rabbits were injected subcutaneously with 2.0 cc of an Indiana virus suspension and four with the New Jersey strain at intervals of one week. The first rabbit of each series received 1, the second 2,

TABLE VII—*Results of experiment to show that guinea pigs are protected by a rat convalescent serum against homologous strains of virus.*

DAY	G.P. 1	G.P. 2	G.P. 3	G.P. 4	G.P. 5	G.P. 6	G.P. 7	G.P. 8	G.P. 9	G.P.10	G.P.11	G.P.12	G.P.13	G.P.14	G.P.15	G.P.16
	Rat convalescent serum (Indiana and New Jersey strains)*										Normal rat serum				Controls	
1	0.5	1.0	2.0	3.0	4.0	0.5	1.0	2.0	3.0	4.0	1.0	2.5	1.0	2.5		
2	Cutaneous inoculation, left hind pad (Indiana strain)					Cutaneous inoculation, left hind pad (New Jersey strain)					Cutaneous inoculation, left hind pad (Indiana strain)		Cutaneous inoculation, left hind pad (New Jersey strain)		Cutaneous inoculation (Indiana strain)	Cutaneous inoculation (New Jersey strain)
4	−	−	−	−	−	+	+	+	−	−	+	+	+	+	+	+
8	−	−	−	−	−				−	−						
12	−	−	−	−	−				−	−						
18	Cutaneous reinoculation, both hind pads (homologous strain of virus)															

*Amounts of serum expressed in cc.
− = No visible lesions.
+ = Primary lesions.

the third 3, and the fourth 4 injections of virus. All rabbits were killed at the same time and the collected serum was mixed and preserved with 0.5 per cent phenol.

The immune serum of the Indiana strain protected against the cutaneous inoculation, which was made 24 hours after the serum injection in doses of 3.0, 4.0 and 5.0 cc, while 0.5, 1.0 and 2.0 cc of immune and 2.5 cc of normal rabbit serum failed to prevent the infection. By the reinoculation, which was made 15 days after the first treatment, the guinea pigs which had shown no lesions had not become immune.

The New Jersey rabbit immune serum protected only with the dose of 4.0 cc, while the smaller doses of the immune serum (0.5, 1.0, 2.0 and 3.0 cc) and the normal serum failed to prevent the development of primary lesions. By reinoculation all the guinea pigs which had shown lesions were found to be immune, while the guinea pigs which had developed no lesions after the treatment with 4.0 cc of immune serum were not immune.

Experiments with pigeon serum: Finally a hyperimmune serum from pigeons was prepared with the Indiana strain in the same way as the rabbit serum. This pigeon serum was used in doses of 0.5, 1.0 and 2.0 cc in guinea pigs, which were inoculated in the usual way 24 hours after the serum injection. The immune serum, as well as 2.5 cc of normal pigeon serum, failed to prevent the development of primary lesions.

General Discussion

The results of the writer's investigations indicate that it is possible to protect guinea pigs completely, even against the primary lesions, by a homologous convalescent or immune serum, if it is injected in sufficient doses and at least 24 hours before the cutaneous inoculation, which otherwise certainly produces primary lesions. Even when virus and serum are applied simultaneously, the guinea pigs can be protected by a homologous convalescent or immune serum but then much larger doses of serum are required to produce the same effect. The protection thus afforded is not so reliable as when the serum is injected at least 24 hours before the inoculation. In the same way white rats could also be protected completely by a homologous convalescent serum. The simultaneous method was not tried in white rats.

In guinea pigs as well as in white rats the convalescent and immune sera proved to be specific in regard to the virus strain

used for the inoculation. The sera protected only against infection with the same (homologous) virus strain as had been used as antigen for the preparation of the serum, while the serum of the heterologous strain as well as normal serum failed to show a protective effect.

Guinea pigs could be protected completely by 0.2 cc of a homologous convalescent serum when applied 24 hours before the usual inoculation but in some other cases even doses of 1.0 cc did not protect all, as shown by the results of the described investigations, in the first instance. The duration of the passive protection depends directly upon the amount of the serum. With the largest dose of 2.5 cc of a homologous convalescent serum, guinea pigs could be protected against the cutaneous infection for about 10 days, while 0.2 cc of the same serum protected for only two days. Besides the amount of serum the protective effect depends very much upon the virulence of the virus used for the inoculation. The relation between the virulence of the virus and the protection afforded by the serum have been reported in another paper.[8] The results indicate that the passive serum protection of guinea pigs can be used for a determination or standardization of the potency of the virus. The latter shows wide variations during the course of the infection.

Furthermore, the investigations show that guinea pigs also can be protected with the convalescent or immune serum from other animals susceptible to vesicular stomatitis. The results obtained with horse and cattle convalescent serum in guinea pigs are similar to those with the (homologous) guinea-pig serum.

The most reliable protective effect, even with small doses, is produced when the serum is administered at least 24 hours before the inoculation, while the simultaneous method requires much larger doses of a heterologous serum in order to establish the same effect. Larger doses of a rabbit hyperimmune serum also prevent primary lesions in guinea pigs when it is administered 24 hours before the inoculation. In contrast with these results a hyperimmune pigeon serum did not show any protective effect in guinea pigs.

In all the experiments the test animals were reinoculated within a period of 2 to 4 weeks after the previous treatment, even when they had yielded lesions from the first inoculation. By these reinoculations it could be shown that some animals, in spite of the treatment with the living virus, did not always acquire an immunity which was strong enough to protect against the cutan-

eous reinoculation. This is surprising, since the results of some of the writer's experiments evidently prove that the inoculated virus can remain alive in the body for several days after the serum injection. It seems to be prevented from exerting its infectious power only as long as the passive serum protection lasts. However, the number of the writer's experiments is still too small to justify definite conclusions. No evident relation could be found between the serum dose, the time and manner of inoculation, and the immunity produced. There were as many experiments in which the animals were found to be immune after reinoculation as there were that were not. Nevertheless, this fact is striking on account of the results of my investigations in active immunization of guinea pigs, which showed that the guinea pig can be protected against the usual cutaneous inoculation by means of a relatively small and superficial treatment with living virus.

Two cases are very noteworthy in which guinea pigs that had shown vesicles after the first treatment with serum and virus and therefore were expected to be immune, developed lesions again when they were reinoculated with the same virus strain 20 to 30 days after the previous treatment. The virus collected from these two guinea pigs has been tested in both cases to determine its type in order to detect the possibility of a mixture of viruses although all the writer's investigations with each strain had been made in entirely separate buildings removed fully 100 yards from each other. Both tests proved that the collected virus was the same type as used for the first inoculation and also for the reinoculation.

The investigations described show their real significance when compared with the conditions in foot-and-mouth disease. The simultaneous application of virus and immune serum in guinea pigs is the basis for the standardization of the hyperimmune serum, which is used in large amounts in Germany for foot-and-mouth disease control. While Waldmann and Pape[11] in their first described serum tests administered the serum 24 hours before the virus was cutaneously inoculated, later on the method has been abandoned in favor of the simultaneous application (Waldmann and Trautwein[13,14]).

The difference between vesicular stomatitis and foot-and-mouth disease is that in foot-and-mouth disease the primary lesions in the guinea pig cannot be prevented even by the largest doses of hyperimmune serum, regardless of whether the serum is adminis-

tered simultaneously or 24 hours before the inoculation. At best the generalization can be prevented only if the dose and the protective effect of the serum are sufficient.

The writer concludes that this difference between foot-and-mouth disease and vesicular stomatitis has its cause in the lower virulence of the vesicular stomatitis virus, as already explained in another paper.[9] The relatively low virulence of the virus of vesicular stomatitis seems to be either destroyed or attenuated by the effect of the serum. If the virus is completely destroyed by the serum, of course it has no effect on the body and therefore the guinea pig remains susceptible after this treatment; but if the serum only attenuates the virus it loses its infectivity but preserves its antigenic properties, so that there results no visible infection but the body becomes actively immune, which is indicated by a complete immunity of the guinea pig after a cutaneous reinoculation.

The difference between the results of Olitsky, Traum and Schoening,[4] who did not succeed in protecting guinea pigs completely in passive immunization tests against vesicular stomatitis, and the writer's investigations, just described, may be explained by the fact that Olitsky, Traum and Schoening[4] practiced in their experiments only the simultaneous method, which in the writer's investigations proved to be unreliable for obtaining a complete and dependable serum protection.

Besides the possibility that a method of immunization against vesicular stomatitis may be developed, the possibility also exists that a satisfactory method of differentiating this disease from foot-and-mouth disease based on passive immunity tests may eventually be evolved.

In those cases in which a questionable virus of the vesicular stomatitis-foot-and-mouth disease group has to be determined, the passive immunization test in guinea pigs should be an aid in differentiating the two diseases. For this purpose a series of guinea pigs is to be injected with a convalescent serum, which is prepared with the suspected virus as antigen and administered in different doses 24 hours before the questionable virus is inoculated cutaneously. If the serum is able to prevent completely the infection with some of the doses administered (also the primary lesions), the virus is proved to belong to the group of the vesicular stomatitis viruses; otherwise it belongs to the foot-and-mouth disease group. The basis for this method is that the vesicular stomatitis virus proves to be constantly of

lower virulence than the foot-and-mouth disease virus. The writer had to work with guinea-pig virus because no fresh virus from a recent outbreak of vesicular stomatitis was available. The investigations were made with transfers of the Indiana and New Jersey strains. Even though there is no evidence that the long-continued passage of the vesicular stomatitis as well as the foot-and-mouth disease virus through guinea pigs lowers their virulence, it is possible that they are different in some respects from the virus of a recent outbreak. Therefore, the proposed test for the differentiation of the two viruses must be checked with fresh virus from a new outbreak before a definite judgment can be given.

Summary

1. Guinea pigs and white rats can be completely protected against a cutaneous inoculation of vesicular stomatitis virus by the administration of homologous or heterologous immune or convalescent serum, given either simultaneously or 24 hours previously.

2. The passive immunity produced is strictly specific in regard to the strain of virus and its duration depends directly on the dose and potency of the serum administered as well as on the virulence of the virus used for the inoculation.

3. The passive immunity test may be used for standardization of the virus.

4. Guinea pigs or rats which developed no lesions after treatment with serum and virus are not always immune, since some of them can be infected when reinoculated 2 to 4 weeks later.

5. The possibility of distinguishing vesicular stomatitis and foot-and-mouth disease viruses by means of the passive immunity test is discussed.

Acknowledgments

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Change in Food and Drug Act Proposed

Consumers, canners and distributors of foods have been invited to discuss proposed changes in the regulations under the McNary-Mapes amendment (July 8, 1930) to the Food and Drugs Act, at a public hearing at the Department of Agriculture, Washington, D. C., April 14, at 10 a. m. The proposed changes in this amendment, if adopted, will mean in general a raising of the requirements for the canned foods already standardized under this act, which permits the canning and marketing, under a specified substandard legend, of foods that are wholesome, but fall below the official quality standards promulgated by the Secretary of Agriculture.

Seize Fish Billed as "Lumber"

When are fish lumber?

"Never," said officers of the U. S. Department of Agriculture, customs agents, and railway officials, February 27, when they stopped delivery in New York City of a consignment of approximately 256 boxes of tullibees. The fish had been consigned by a lumber company in Winnipeg, Canada, to a dealer in New York, billed as "rough poplar lumber." Examination of samples by an inspector of the Food and Drug Administration disclosed them to be heavily infested with worms, and shipment of the fish was therefore illegal under the Federal Pure Food Law. The shipment, amounting to more than 25,000 pounds, was valued roughly at $2,500.

A COMPARISON OF CARBON TETRACHLORIDE AND TETRACHLORETHYLENE

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Judging by various comments appearing in veterinary literature and elsewhere, it would seem that some misunderstanding has arisen about the use of tetrachlorethylene that is well worthy of correction. For instance, it has been erroneously stated:

1. That tetrachlorethylene is similar to carbon tetrachloride in that it causes asphyxiation in cases where it enters the respiratory organs;
2. That it produces an injurious effect on the liver;
3. That it is dangerous to use in case animals are suffering from the effects of calcium deficiency.

The object of this article is to determine whether there is any justification for the beliefs expressed above.

As may be seen by the following table, carbon tetrachloride and tetrachlorethylene are similar in certain physical features, and both belong to the chlorine group of compounds; however, there are several very important differences between them that should be considered.

	Tetrachlorethylene	*Carbon tetrachloride*
Chemical formula	C_2Cl_4	CCl_4
Form	Liquid	Liquid
Color	Colorless	Colorless
Odor	Ethereal	Aromatic
Specific gravity	1.619 at 20° C.	1.632 at 0° C.
Boiling point	121-122° C.	77° C.

THE EFFECTS OF TETRACHLORETHYLENE ON THE RESPIRATORY ORGANS

In regard to the possibility of tetrachlorethylene causing asphyxiation, it should be noted that it has a much higher boiling point than carbon tetrachloride; consequently there is less danger of it causing asphyxiation even though the drug accidentally enters the trachea or lungs.

A number of tests have been made to determine whether tetrachlorethylene is capable of causing asphyxiation. For instance, Schlingman[1] introduced 1 cc of tetrachlorethylene into the larnyx of a dog weighing about 15 pounds, by means of a pipette. No ill effects followed other than a slight cough. Another dog was

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injected intratracheally with 1 cc of tetrachlorethylene, without fatal results, although vomiting, retching and dyspnea followed, as might be the case if water were injected into the trachea.

In order to determine whether foxes are likely to be affected when tetrachlorethylene enters the respiratory organs (as might occur if a capsule were accidentally broken in the mouth) Hanson[2] broke six 1-cc capsules in the mouth of each of two foxes without any ill results following, other than a temporary irritation of the mouth as evidenced by profuse salivation and by the rubbing of the mouth with the paws. Hanson adds:

> Under similar conditions the use of carbon tetrachloride would undoubtedly have brought about collapse and possibly death from inhalation-intoxication.

More recent observations by Hanson[3] have shown that tetrachlorethylene does occasionally cause inhalation-intoxication in foxes. Consequently, it should be administered in soft gelatin capsules and the patient closely watched to see that the capsule is successfully swallowed. In case a capsule is broken in the mouth and signs of collapse develop, such as dilation of the pupils, trembling and general "grogginess," it is advisable to commence artificial respiration. One recommended method is to grasp the animal by the hind legs and to whirl it around in order to centrifuge the drug from the lungs; then lay the animal down on the ground and perform artificial respiration.

Cases of choking and death have been occasionally reported in dogs following the administration of tetrachlorethylene enclosed in capsules, but when such cases are properly investigated it is usually found that death was due to a capsule being pushed down the trachea, with resulting mechanical suffocation. Occasionally a hog may die following the administration of drugs in capsules. This may be attributed either to a capsule having been pushed into the trachea or having lodged in the retropharyngeal recess or blind pouch, setting up irritation and swelling, the capsule itself causing death by suffocation.

Lamson, Robbins and Ward[4] found it impossible to produce surgical relaxation (anesthesia) in certain dogs with tetrachlorethylene when using an ordinary ether-bottle attached to a tracheotomy-tube, even though the tetrachlorethylene was heated. Anesthesia could, however, be induced by the cone method.

The Effects of Tetrachlorethylene on the Liver and Other Organs

In comparing the toxicity of tetrachlorethylene with that of carbon tetrachloride on dogs, experimental evidence has shown that the former has no appreciable effect on the liver, whereas carbon tetrachloride does cause necrosis of the liver, even though there may be no external symptoms. Again quoting from Drs. Lamson, Robbins and Ward[4]:

> Dogs have been given doses of tetrachlorethylene up to 4 cc per kilo at intervals of 2 or 3 days for a period of several months without producing any pathological changes in the liver.

Dizziness and incoördination of muscular movement may occasionally follow the administration of tetrachlorethylene, but as a rule such symptoms disappear rapidly, leaving no after-effects. According to Lamson, Robbins and Ward,[4] dizziness following the administration of tetrachlorethylene is probably due to either exceptionally large doses or to the presence of oily or fatty food in the gastro-intestinal tract at the time of treatment. Oily or fatty foods, therefore, should be excluded from the diet twenty-four hours or so prior to the administration of tetrachlorethylene, and for several hours afterwards, to prevent absorption of the drug from the intestine. Under ordinary circumstances, there being no oils or fats in the intestinal tract, tetrachlorethylene does not seem to be absorbed in dogs even when administered in relatively large doses. Again quoting Lamson, Robbins and Ward[4]:

> If normal dogs are given doses of tetrachlorethylene up to approximately 10 cc per kilo, or *fifty times the therapeutic dose*, no indication of the absorption of the drug in appreciable amounts is to be observed.

The Effects of Tetrachlorethylene in Case of Calcium Deficiency

Some writers appear to be of the opinion that tetrachlorethylene is dangerous in cases of calcium deficiency; but this opinion does not appear to have been sustained by proof. According to Minot,[5] "carbon tetrachloride does produce some ill effect in dogs and other animals with low calcium balance," but tetrachlorethylene does not seem to have such action, at least in domestic animals. Lamson, Robbins and Ward administered tetrachlorethylene to cats and dogs previously fed on a diet deficient in calcium, and no ill effects followed. Similar results were obtained by Schlingman in treating dogs with tetrachlorethylene, which had previously been prepared by being fed on a calcium-deficient diet.

As far as sheep or goats[6] are concerned, tetrachlorethylene does not appear to have any injurious effect on them because treatment has been given at monthly intervals under carefully controlled experimental conditions for a period of over a year without any appreciable ill results.

Deaths have followed the administration of 1 cc of carbon tetrachloride when given for the removal of liver fluke in sheep, but the reason for such deaths has not yet been clearly established. Dr. Robert Jay, in discussing an article by Dr. J. N. Shaw,[7] stated that deaths appeared to be due to some unaccountable predisposition to injury by carbon tetrachloride brought about by the change of feed resulting in increased thrift of the sheep.

As far as the writer is aware, no deaths have been recorded in sheep or goats that could be attributed to the effects of tetrachlorethylene, *per se*, even though thousands of animals have been treated with this drug during the last few years. Assuming that many animals must have been suffering more or less from calcium deficiency at the time of treatment, it would appear that tetrachlorethylene has no injurious effect in cases of this kind.

Comparing the efficiency of tetrachlorethylene with that of carbon tetrachloride, the former appears to be as effective as the latter in removing nematodes; moreover, its wider margin of safety (due to its less volatile nature) and its less injurious effect upon the liver, recommend it in preference to carbon tetrachloride for the removal of hookworms, ascarids and other nematodes in dogs, cats, foxes and other animals.

A word of warning might be offered in regard to the selection of chemically pure tetrachlorethylene. It is known that some of the tetrachlorethylene on the market contains harmful impurities, so that it is advisable for veterinarians to select a chemically pure product from a reliable source, in order to avoid trouble and possible embarrassment.

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A PRACTICAL METHOD FOR THE DIAGNOSIS OF PREGNANCY IN THE MARE*

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INTRODUCTION

It is generally recognized that in the economic production of domestic animals efficiency in reproduction is one of the prime objects to be attained. A large number of factors are involved in obtaining high reproductive efficiency. In animals with a long gestation period, such as the mare, it is at times of considerable importance for breeders to have definite knowledge of the existence of pregnancy at the earliest possible date following service.

The gross anatomical changes which take place in the female genital tract after conception are quite marked. In the mare these changes may furnish a means by which, on physical examination of the animal, in the great majority of cases, the existence of pregnancy can be quite definitely determined after a certain interval of time has elapsed following the establishment of pregnancy. The interval of time required depends to some extent on the breed and the individual animal, but more particularly on the skill and experience of the person making the examination. Dimock and Fincher[1] have reported their work on this method of diagnosis of pregnancy. In experienced hands it may be considered to be quite accurate for animals pregnant two months or longer. Earlier diagnosis is frequently possible in animals of the light horse breeds than in heavy draft mares.

Recent advances in knowledge of the endocrine glands and their hormones have made it possible for the development of a highly accurate biological test for pregnancy in some species, including the mare, which has some advantages over the manual method. The presence of an ovarian hormone, termed folliculin, or oestrin, in the blood of non-pregnant sexually mature animals was first noted by Frank and co-workers[2] and Loewe,[3] working independently. Fels[4] found this substance to be present in increased amounts in gravid blood of women, and this was later confirmed by Aschheim and Zondek.[5] Smith and Engle,[6] and Zondek and Aschheim,[7] working independently of each other,

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demonstrated the relationship of the sex-maturing hormone of the anterior hypophysis to the ovaries. Aschheim and Zondek[5] demonstrated the presence of oestrin and the sex-maturing hormone of the anterior hypophysis in the blood serum and urine of pregnant women, and demonstrated the value of their presence in the diagnosis of pregnancy as early as the seventh day. In this work they used the immature mouse as the test animal.

Studies in the Mare

Since the publication of the work cited above, we have been interested in a study of the concentration of the hormones in the blood of domestic animals. Our first work was done on the mare. We have access to these animals through all stages of pregnancy, and their blood serum has no deleterious effects on the test mice and rats when injected subcutaneously in rather large doses, repeated several times. The complete data on this work have been published elsewhere (Cole and Hart,[8,9] and Cole, Howell and Hart[10]), and the reader is referred to them for detail.

We have shown that the blood of non-pregnant mares does not contain any substance in sufficient concentration at any stage in the oestrous cycle to elicit a response in the genital system of the immature mouse or rat when the serum is given in doses up to 30 cc. After breeding which results in conception, the reactions are uniformly negative up to the 37th day of pregnancy. The time of the first reaction with serum from pregnant mares varies from the 37th to the 42nd day of pregnancy. For example, mare 9 reacted on the 37th day of pregnancy, and mares 10 and 5 on the 39th. Mare 3 showed no reaction on the 26th, 33rd and 38th days, but was positive on the 41st day. Mare 4 showed no reaction on the 27th, 34th and 39th days, but reacted on the 42nd day.

The reaction of the rats to the serum taken at this early period of pregnancy can be observed with the naked eye only in the uterus. The weight of the rat ovaries are comparable to that of control ovaries. However, when the ovaries are examined histologically after serial section, one or occasionally two follicles are usually found that are larger than follicles of control animals. Also clear-cut histological changes occur in the vagina and these changes may be determined by examination of the vaginal smear. The concentration of the hormone in the blood increases rapidly during the few days following its first appearance, and after the

42nd day of pregnancy, the serum has a tremendous effect upon the size of the ovaries of the test animals, and changes are regularly induced in the vagina and uterus. A maximal effect is produced in the ovaries between the 43rd and 80th days of pregnancy, after which time there is a gradual diminution in effect, appearing earlier in some cases than in others, until at about the 180th day of pregnancy, when the test ovaries are again comparable in size to the ovaries of the controls.

Reactions may still be obtained in the uterus and vagina of the immature rats until the end or a few days before the end of pregnancy. During the later stages of pregnancy, it is necessary to inject 25 to 30 cc of serum in order to produce the effect.

During this work a total of 51 male rats and 7 male mice were injected with varying doses of serum that produced positive reactions in the females. With this number of injected animals there were maintained 35 controls. In all cases tested when the hormone was at a high concentration, in the serum there was an increase in the size of the testes of the injected rats in proportion to their body weights as compared with the controls. In many instances the increase in the size of the testes was small, never being more than double that of the controls. Further unpublished data (Cole and Guilbert) have shown that the accessory genital organs are affected to a greater extent than the testes; the seminal vesicles and prostate being increased in size three or four times by the injection of pregnant mare serum. However, the effect of the serum upon the accessory reproductive organs of the male has not been determined for all stages of pregnancy. Thus, until more data have been accumulated, it will be necessary to use only the female rats or mice.

Tests to Determine if Oestrin as Well as Anterior Hypophyseal Hormone Was Present in Pregnant Mares

In order to ascertain if oestrin as well as anterior hypophyseal hormone was present in the serum of pregnant mares, normal female mature and immature rats were spayed and allowed to recover from the operation. Serum was taken from mare 4 on the 121st day of pregnancy. Four spayed rats were injected with 10 cc per day of the serum and after 72 hours showed a reaction in the vagina by the presence of an oestrous smear. Four unspayed rats injected with 1 cc of the serum and killed at 96 hours showed positive reactions in the ovaries. In this particular case 30 cc of serum were required to produce the oestrin

reaction, whereas 1 cc was sufficient to demonstrate the sex-maturing hormone.*

Method of Diagnosing Pregnancy in the Mare

In carrying out this method of diagnosis of pregnancy, it is necessary to have available a breeding colony of white mice or rats, which are maintained in many biological laboratories. The young animals of either of these species are allowed to nurse their mothers until weaning time. They are weaned on the 21st day and injected at this time. However, it is found entirely practical to vary the age from 18 to 23 days. The test animals are killed 96 hours after the first injection, thus making them 22 to 27 days of age, depending on when the injections are started. Abundant evidence exists that these animals never come into oestrum at this early age under normal conditions.

The mares to be tested should have been bred about 45 days previous to the time when the blood sample is taken. We have positive tests with urine. However, the concentration of the anterior hypophyseal hormone in the urine of mares is very low as compared with that in their blood. It is likely to be contaminated with organisms that will kill the injected animal before the reaction can be elicited. Mixing disinfectant with the urine to stop the growth of bacteria has some objections. It has proved easier with us to collect blood than urine from the mares and with ordinary precautions the serum never causes any serious effects on the injected animal. We, therefore, do not have very much data on reactions with urine but data that we have would indicate that it is not so satisfactory as blood serum for the test. Recently Küst[12] has reported his work in the veterinary clinic at Giessen, Germany, in which he has used urine of the mare in the diagnosis of pregnancy. From his tables the method of testing used by him does not seem to give the definite results that we have obtained with serum. His work has apparently been based entirely on the ovarian hormone present in the urine.

The blood is drawn by tapping the jugular vein with a 14- or 15-gauge hypodermic needle, into a sterile glass receptacle such as an Erlenmeyer flask of 100 to 250 cc capacity. The site of puncture should be wiped with cotton saturated in dilute alcohol or other disinfectant before inserting the needle. Depending on the stage of pregnancy, from 50 to 250 cc of blood are sufficient for the test. This is usually drawn the day before the injections

*Zondek[11] has demonstrated that the urine of mares late in pregnancy contains tremendous quantities of oestrin and we have confirmed this finding.

are made and kept in the ice-box over night to allow the serum to separate. After the serum has separated from the clot and has been poured off, it can be shipped long distances for the test, because the hormones in it remain active for weeks or months.

A group of at least three immature mice or rats should be used for each routine test, two of which receive the injections of the serum to be tested, and the third is left as the control. Two or three injections of 0.2 cc each in mice, and 2 cc each in rats, or a single injection of 0.5 cc in mice and 5 cc in rats is sufficient to elicit the reaction. If three injections are made, the first may be given at 1 p. m., the second at 5 p. m., and the third the following morning at 9 a. m. The animal to be injected is held by an assistant, the skin washed with cotton saturated in dilute alcohol or other disinfectant, and the serum injected subcutaneously in the abdominal region. A hypodermic syringe is used, with a fine-gauge (22) needle 1 to 1½ inches long, so it can be passed for some distance under the skin from the point of insertion before the serum in injected. This reduces leakage from the needle-hole when the needle is withdrawn. Serum brought from the ice-box at time of injection should be warmed by enclosing the glass syringe containing it in the palm of the hand to bring it near body temperature when a single injection is to be given, to reduce shock and hasten absorption. Five cc may seem a large quantity of fluid to place under the skin of a 21-day-old rat at one time, but they stand it very well when ordinary care is used.

The injected animals and the control are left in a cage on a normal stock diet, such as McCollum diet 1, until 96 hours have elapsed from the time of the first injection. A vaginal smear is then made and examined under a low power of the microscope, without staining. The vagina of the control will still be closed and if the membrane is punctured, the smear will show leucocytes and epithelial cells in scanty numbers, which indicates the resting stage between heat periods. If the injected animals are going to show a positive test, the vagina will be open or the closure membrane may be easily punctured, and in all cases the smear will show epithelial cells or cornified cells of oestrum in considerable numbers. A little experience is required to recognize the stage of the cycle in the rat from the microscopic examination of the vaginal smear with the low-power, dry lens of a compound microscope. The spatula used for making the smear can be obtained from dental supply houses. After it has been wiped off following immersion in dilute alcohol, it is passed into the vagina

of the rat. During this operation the rat is held in the palm of the left hand with its abdomen toward the operator. The vaginal contents collected on the spatula is diluted on a glass slide with a small drop of physiological salt solution and the preparation examined immediately without drying or staining.

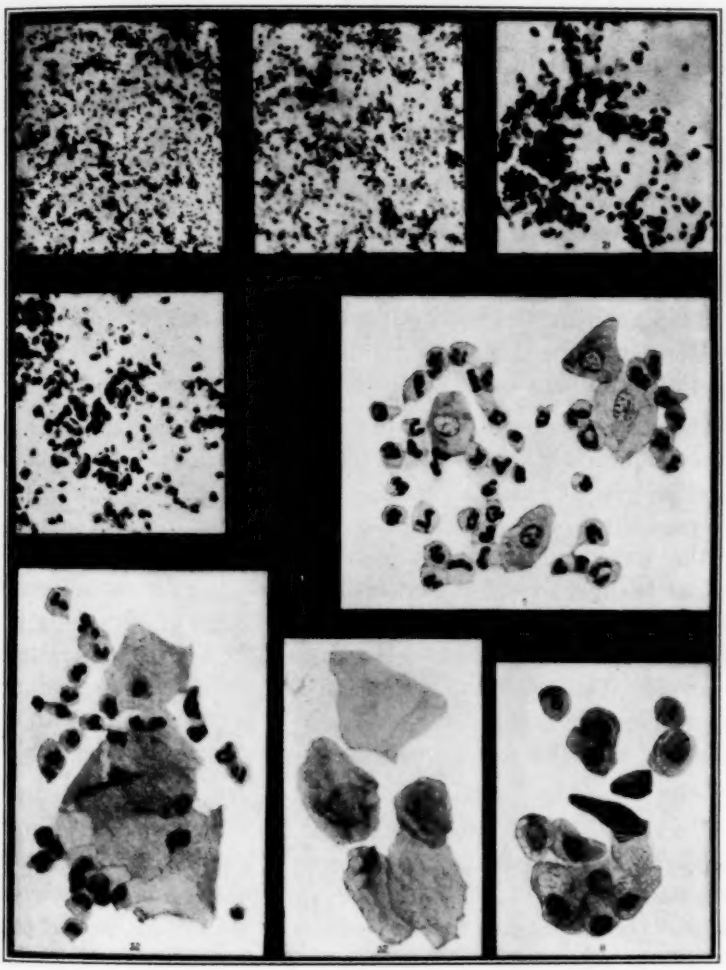

Fig. 1. Vaginal smears at various periods of the oestrous cycle (after Long and Evans [12]).
4, 10, 21 and 31, smears as they appear under the microscope at low magnification (x36).
5, 11, 22 and 32, at high magnification (x436).
4 and 5, polymorphonuclear leucocytes and epithelial cells characteristic of dioestrum.
10 and 11, epithelial cells found in early oestrum.
21 and 22, cornified cells found in late oestrum.
31 and 32, polymorphonuclear leucocytes and cornified cells found just following oestrum.
4 and 5 illustrate negative vaginal reactions. All others are evidence of a positive vaginal reaction.

Figure 1 shows the cell picture, under the microscope, of the four stages of the cycle.

The animals are then killed, pinned out on a board and their genital tracts examined by opening the abdomen. The uterus is separated from the vagina with scissors and removed with the ovaries intact. The excess fat is removed and the organs weighed, after which the ovaries and oviduct, with bursa attached, are removed from the uterus and weighed separately. The marked difference between the injected animals and the control, in size and weight of the uterus and sometimes the ovaries, depending on the period of gestation, is so marked that positive reactions can be recognized on macroscopic examination, as illustrated in figure 2.

Variations in Reactions Depending on Stage of Gestation

It is significant to know that in the mare there are four typical reactions obtained, varying in degree and parts of the genital tract affected, depending upon the stage of pregnancy.

The earliest reaction from the 37th to the 42nd days of pregnancy is probably a reaction of the sex-maturing hormone of the anterior hypophysis. Although changes in the ovary are slight, the possibility of these changes being sufficient to induce changes in the uterus and vagina must be considered. We induced similar changes by the injection of minute doses of serum known to contain the sex-maturing hormone in large quantities, giving further indication of the reaction being one of the sex-maturing hormone. There will be few routine diagnostic tests made during this stage, as in general it will be safer to wait until the 45th day following breeding before collecting the blood samples for the test.

The reactions obtained from serum taken at the 45th to about the 80th day of pregnancy are strikingly similar to the reactions obtained by Smith and Engle[6] with implantation of hypophyseal tissue. Ovaries were produced in our cases at this period comparable in size to the largest ovaries produced by their implant method.

Between the 80th and 150th days there is a gradual diminution of the effect upon the ovary. At the later date, the ovaries from animals giving clear-cut reactions in the vagina and uterus were comparable to control ovaries, both as regards their weight and their histological appearance. The period from the 45th to the

Fig. 2. Reactions in rats.

1, control. 2, 3 and 4 show equally positive uterine reactions but varying degrees of ovarian reactions. Ov., ovaries; ut., uterus.

150th day is the time when most routine diagnostic tests will be made.

Mare 4 gave both an oestrin and a sex-maturing reaction at the 111th day of pregnancy and we are of the opinion that the period between the 80th and 150th days is the period in which the sex-maturing hormone disappears in the serum and oestrin appears.

The fourth period, extending from the 150th day to later stages of pregnancy, regularly shows reaction of the uterus and vagina with no change in the ovary. Therefore, we are probably getting an oestrin reaction alone at this time, although we realize that the absolute test upon this point rests upon the chemical separation and subsequent testing of the separate fractions.

That the reaction obtained in immature rats by the injection of serum taken from mares 45 to 120 days after breeding is of great value in diagnosing pregnancy is beyond doubt. This is the period of time in which the diagnosis is of greatest practical value. During this period one is impressed with the uniform results obtained. Several hundred rats have been injected with serum obtained during this period and all rats receiving 5 cc or more gave a positive reaction.

We have evidence that there is a reduction in the concentration of the hypophyseal hormone and an increase of oestrin late in pregnancy. Therefore, at this period larger doses will be necessary to produce reactions in the test animals, but other means of diagnosing pregnancy in the mare are available during this period. When the test is to be used from about the 120th day until the end of pregnancy, 25 to 30 cc, in 3 to 6 doses, over a three-day period, has regularly given positive reactions most pronounced in the vaginal smear.

In tests for pregnancy in women, some pathological conditions of the genital apparatus have been encountered which produced positive reactions in the absence of pregnancy. Such conditions are rare in mares and this fact, coupled with the results we have obtained in testing 72 live mares and 38 mares at time of slaughter, with only one doubtful result, give ample evidence of the high accuracy of this test in this species. The doubtful case was tested with negative reaction on the 35th day, at which time we would expect this result. A second test made on the 44th day was positive. The mare then passed from under our observation and never gave birth to a foal. Abortion could have occurred in this case without being observed and it should be recognized

that abortions following positive reactions are not to be considered as any limitation to the accuracy of the test.

Practical Applications of the Test in Horse Breeding

There are many conditions arising in which the knowledge afforded by this test is of value. Where brood mares are being sold at public or private sale, it may be stated that the mare was served by such and such a stallion, with date of last service, and is believed to be in foal. This, however, may be no warranty that she is in foal. The value of the mare may be greatly enhanced if it could be stated positively, on such a test as this, that she actually is in foal.

A stallion may be kept on a breeding farm for service to outside mares. These mares are brought to the farm with the intention of leaving them there until they are in foal. With this test the existence of pregnancy can be definitely ascertained and the mares sent home a considerable length of time ahead of what would be the case without it.

Mares bred early in the season and showing no further signs of heat are usually considered settled but such may not be the case. If a negative test for pregnancy were obtained in such cases, means might be used to bring them in heat so they could again be bred before the close of the breeding season.

Mares may be purchased for work under conditions in which pregnancy would be highly undesirable and this test could definitely eliminate them from such purchases.

The simplicity of the test, its high degree of accuracy and its low cost where facilities are available will render its use under many other conditions a justifiable procedure, eliminating much guess work regarding the existence of pregnancy in brood mares in the stud.

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Dog-Owners See Veterinary Exhibit

The Southeastern Michigan Veterinary Medical Association again had an educational exhibit at the Detroit Dog Show, March 4-6, 1932. This year the main part of the exhibit was a model operating-room of a small-animal hospital, completely equipped with operating-table, instrument cabinet, sterilizer, ultra-violet ray machine and other articles usually found in a modernly equipped establishment. Another part of the exhibit was devoted to the use of the x-ray in veterinary practice. Numerous x-ray photographs were displayed, showing conditions in which the x-ray is useful for diagnostic and other purposes. There were 714 dogs benched and several thousand pet-owners viewed the exhibit during the three days of the show.

Range Cattle Being Tested

Systematic tuberculin-testing of range cattle in the Panhandle district of Texas and other parts of the southwestern plains region is now in progress in accordance with a plan developed to meet conditions of such regions. A recent report received by the U. S. Department of Agriculture from officials in Texas shows that approximately 7,500 cattle were tested in about two weeks by four veterinarians. The new basis for accreditation requires the testing of at least 10 per cent of the cattle in any range or semi-range area. Similar testing is also progressing satisfactorily in northwestern Oklahoma and southwestern Kansas.

The splendid coöperation of the stockmen in this region is typified by the attitude of the owners of one of the largest herds of registered beef cattle in the United States. They not only coöperated to the fullest extent in testing their cattle, but waived the special exemption provision and subjected the entire herd to the test. No reactors were found.

The testing in this section of the country must necessarily be done in the fall, winter, or spring months, when the cattle are most readily brought under control.

BACTERIAL FLORA OF THE INTESTINAL TUBE OF NORMAL YOUNG LAMBS*

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A study of the bacterial flora of the intestinal type of young lambs suffering from an acute infectious diarrhea prompted an investigation of the organisms to be found in the intestines of healthy lambs. No information upon this particular problem could be found in the available literature. This diarrhea has never been observed excepting among lambs born in lambing-sheds.

It is customary for the sheepmen of the northwestern states, who make it a practice of lambing early (February, March and April), to use sheds for shelter against inclement weather. These lambing-sheds are of various types of construction. They are equipped with rows of small pens, known as jugs, just large enough to hold a ewe and her offspring. The drop band is held in corrals opening out from the shed or in close proximity thereto. Some of the better equipped outfits have provided sufficient space in the lambing-shed to house the drop band in case of a storm.

The lambs are born among the drop band, and the ewe and lamb are then brought into the shed, placed in a jug and hand-suckled. Here they remain for periods varying from twelve to seventy-two hours, depending upon facilities and the health of lambs and ewes.

The sanitation of the drop band and lambing-shed varies with different owners and the prevailing weather. Rain or snow naturally makes the sheds wet or at least damp and the drop-band corrals muddy. The jugs may or may not be cleaned and freshly bedded before each occupancy. It is under such conditions and during the first three days after birth that infectious diarrhea cases make their appearance.

PROCEDURE

This investigation was carried out during the lambing seasons of 1930 and 1931. The lambs were of a cross-bred type. Selection of lambs was made from two shed-lambing outfits where the sanitary conditions were of the highest type.

*Contribution from Montana State College, Agricultural Experiment Station, Paper No. 9, Journal Series. Received for publication, October 12, 1931.

Nine lambs were included in this study. Eight of them were selected from one outfit employing the typical shed-lambing procedure and the other lamb (163) came from an outfit located some thirty miles from the first. On this ranch, the lambing was a little later in the spring, with the result that the lambs were being born away from the shed and corrals on the green grass of the open range. However, the lambs and ewes were brought to a shed immediately after birth, and from this point on conditions and practices were the same as for the regular shed-lambing. Both lambing outfits were located in the Gallatin Valley. The lambs had been observed continuously from the time of birth, and were healthy.

Death was produced by chloroforming. Cultures were taken immediately. The abdominal cavities were opened aseptically. The duodenal, jejunal and ileac portions of the small intestine and the cecum and colon were selected for culturing. The intestinal wall was seared with a hot spatula, then pierced with a Pasteur pipette for removal of the fluid contents. Solid contents were often times encountered in the cecum or colon. In this case the seared wall was pierced with the point of a sterile knife so that the material to be cultured could be removed with a loop.

Tubed hormone broth, 2 per cent hormone-agar slants and plates, and Endo's agar plates were employed for aerobic cultivation. The broth and agar media were corrected to pH 7.2. For the Endo's plates a dehydrated medium was employed. Freshly prepared, deeply tubed meat-piece liver broth (pH 7.4) and Hall's brain medium without seals were used for anaerobic cultivation. The Endo's agar plates were poured in series of six after a proper dilution of the intestinal contents had been made in saline blanks. This was accomplished by removing from each selected section approximately 0.5 cc of the fluid intestinal contents. A first dilution was made in a 10-cc saline blank, from which 0.25 cc was removed to be diluted in a second 10-cc saline blank. A sufficient quantity of this dilution was inoculated into six melted-agar tubes in series, to insure the proper distribution of colonies on several of the plates, the purpose being to determine the relative abundance of the species present, rather than the total count.

Cultures were incubated at 37.5° C, for two days. Primary isolations and stained smears were made after the first day of incubation. Anaerobic cultures were re-incubated a second day for further development of additional organisms. Cultural

work for the identification of anaerobes from this age and type of lamb had previously enabled us to identify *C. welchii* and *C. tertius* from their morphology. However, the Gram-negative aerobes were carefully purified, after which the various biochemic and carbohydrate reactions were determined as indicated by table II.

Endo's agar was used for the purpose of differentiating between the colon and paratyphoid groups. The aerobes which developed from these inoculations all produced the red metallic sheen. From each series of plates, a number of these colons were picked for future identification. This was thought desirable, because of the possibility of more than one species of Escherichia being present in the same intestine. This did prove to be the case in three lambs (163, 285 and 284). See table I.

Experiments and Results

A tabulation of the nine lambs, their ages at the time of autopsy, and the bacterial content for each portion of the intestinal tube is to be found in table I. It will be noted that the ages of the lambs included in this study varied between fifteen and seventy-four hours. Selection of lambs of this age was made that they might be exactly comparable to the ages at which the infectious diarrhea makes its appearance. A study of the lambs in table I was made during two lambing seasons. The first three were cultured during April and May, 1930, and the remaining six in February and March, 1931. This entire group of lambs was healthy and normal in every way. No special care had been given them other than all such lambs raised under comparable shed conditions would have received.

Lamb 141: Anaerobic, brain-medium tubes and agar slants inoculated from the contents of the duodenum, ileum and cecum yielded *C. welchii* and a Gram-positive diplococcus. An Escherichia species was isolated from the ileum and cecum but not the duodenum. The jejunum and colon were not cultured.

Lamb 163: Duodenum, ileum, cecum and colon were cultured in anaerobic, brain-medium tubes and on agar slants. Duodenal cultures were sterile. From the ileum, cecum and colon, *C. welchii* and a Gram-positive diplococcus were isolated. *E. anindolica* was isolated from the ileum and *E. alba* from the cecum and colon.

Lamb 152: Anaerobic, brain-medium tubes and agar slants were used in culturing the duodenal, ileac, cecal and colic contents. A Gram-positive diplococcus and an Escherichia were isolated from each portion of the intestine. *C. welchii* was present in all excepting the duodenum.

Duodenal, jejunal, ileac and cecal contents from the last six lambs listed in table I were cultured on Endo's agar plates and in meat-piece liver broth in addition to the hormone-agar slants or plates.

Lamb 308: A Gram-positive diplococcus and an atypical *E. communior* strain were isolated from duodenal, jejunal, ileac and cecal contents. The cecal contents also contained *C. welchii*. This *E. communior* strain was atypical

TABLE I—*Bacterial flora of intestines of normal lambs.*

LAMB	AGE (HRS.)	BACTERIOLOGICAL RESULTS				
		DUODENUM	JEJUNUM	ILEUM	CECUM	COLON
141	15	*C. welchii* G+ diplococcus	Not cultured	*C. welchii* G+ diplococcus Escherichia sp.	*C. welchii* G+ diplococcus Escherichia sp.	Not cultured
163	24	Sterile	Not cultured	*C. welchii* G+ diplococcus *E. anindolica*	*C. welchii* G+ diplococcus *E. alba*	*C. welchii* G+ diplococcus *E. alba*
152	31	G+ diplococcus Escherichia sp.	Not cultured	*C. welchii* G+ diplococcus Escherichia sp.	*C. welchii* G+ diplococcus Escherichia sp.	*C. welchii* G+ diplococcus Escherichia sp.
308	46	G+ diplococcus *E. communior* (atypical)	G+ diplococcus *E. communior* (atypical)	G+ diplococcus *E. communior* (atypical)	*C. welchii* G+ diplococcus *E. communior* (atypical)	Not cultured
285	60	*C. welchii* *C. tertius* G+ diplococcus *E. communior*	*C. welchii* *C. tertius* G+ diplococcus *E. communior*	*C. welchii* *C. tertius* G+ short-chain streptococcus *E. communior* *E. enterica*	*C. welchii* *C. tertius* *E. communior*	Not cultured
309	62	G+ diplococcus Escherichia sp.	G+ diplococcus Escherichia sp.	*C. welchii* G+ diplococcus *E. communior*	G+ diplococcus *E. communior*	Not cultured

306	63	Sterile No anaerobic cultures	G+ diplococcus *E. pseudocoloides* (atypical) No anaerobic cultures	*E. pseudocoloides* (atypical) No anaerobic cultures	*E. pseudocoloides* (atypical) No anaerobic cultures	Not cultured
284	73	*C. welchii* G+ diplococcus Escherichia sp.	*C. welchii* G+ diplococcus Escherichia sp.	*C. welchii* *C. tertius* G+ diplococcus *E. anindolica*	*C. welchii* *C. tertius* G+ diplococcus *E. anindolica* *E. communior*	Not cultured
307	74	G+ diplococcus *E. communior*	*C. welchii* G+ diplococcus *E. communior*	*C. welchii* G+ diplococcus *E. communior*	G+ diplococcus *E. communior*	Not cultured

G+ = Gram-positive.

TABLE II—*Cultural reactions.*

Culture		Morphology	Gelatin liquefaction	Motility	Litmus Milk	Acetyl Methyl Carbinol	Indol	KNO_3 reduction	Endo's Agar Colonies	Carbohydrate Reactions*						Name
Number	Origin									Lactose	Sucrose	Dextrin	Dulcite	Salicin	Raffinose	
141	Ileum, cecum		−		Acid curd, reduction	−	+	+		+						Escherichia sp.
163.11	Ileum		−	+			+	+	Red metallic sheen	+	+	+ 0	+	−	+	*E. anindolica*
163.12	Cecum, colon		+	+	Acid, late soft curd	−	−	+	Colorless	+	−	−	−	−	−	*E. alba*
152	Duodenum, colon	Gram-negative rods	−		Acid, curd, and reduction	−	+	+	Red metallic sheen	+					+	Escherichia sp.
308	Duodenum, jejunum, ileum, cecum		−			−	+	+		+	−	−	+	−	+	*E. communior* (atypical)
285			−			−	+	+		+	+	−	+	+	+	*E. communior*
285.11	Ileum		−				+	+		+	−	+	+	+	−	*E. enterica*
309	Ileum, cecum		−			−	+	+		+	−	−	+	+	+	*E. communior*
306	Jejunum, ileum, cecum		−			−	+	+		+	+	+	−	−	+	*E. pseudocoloides* (atypical)
284	Ileum, cecum		−	−		−	+	+		+	+	−	+	−	+	*E. anindolica*
284.4	Cecum		−	+		−	+	+		+	+	−	+	+	+	*E. communior*
307	Duodenum, jejunum, ileum, cecum		−			−	+	+		+	+	−	+	+	+	*E. communior*

*Acid and gas also produced from dextrose, maltose, xylose, arabinose, glycerin, galactose, levulose and mannite and no action upon inulin.

in that no gas was formed from sucrose and salicin. This lamb, although normal at autopsy, had been fed, before suckling, 25 cc of a broth culture of a gelatin-liquefying Escherichia. The lamb failed to develop symptoms of any kind and was perfectly normal. Upon postmortem examination all organs were normal and the intestinal tube yielded the customary flora. None of the inoculated liquefiers were recovered. Therefore the flora was considered normal and included in this study.

Lamb 285: *C. welchii*, *C. tertius* and *E. communior* were isolated from all four cultured portions. A Gram-positive diplococcus also was obtained from the first two sections. A Gram-positive, short-chained streptococcus and a second Gram-negative species identified as *E. enterica* also were isolated from the ileum.

Lamb 309: A Gram-positive diplococcus was found in all four portions of the intestine which were cultured. An Escherichia which was not completely identified as to species was found in the duodenum and jejunum. *C. welchii* was isolated only from the ileac portion of the intestine. *E. communior* was isolated from the ileac and cecal contents.

Lamb 306: The duodenum was sterile. The jejunum yielded a Gram-positive diplococcus and an atypical *E. pseudocoloides* also found in the ileum and cecum. Anaerobic cultures were not prepared from this lamb.

Lamb 284: *C. welchii* and a Gram-positive diplococcus were isolated from each of the four sections of the intestine. An Escherichia not completely identified as to species also was isolated from the duodenum. From the ileum and cecum, *C. tertius* and *E. anindolica* were isolated. The cecal contents also yielded *E. communior*.

Lamb 307: A Gram-positive diplococcus and *E. communior* were isolated from each of the four portions cultured. *C. welchii* was isolated from the jejunal and ileac contents. The mother of this lamb had not enough milk to feed her triplets, so after the first day this lamb received cow's milk in place of the ewe's milk. The lamb was perfectly normal when autopsied. The intestinal flora was no different from that encountered in the other lambs in spite of the altered diet.

The cultural characteristics and carbohydrate reactions by which the different species of the Escherichia genus were determined are grouped in table II. The predominating Escherichia species from each lamb is given along with the cultural reactions by which the determinations were made. In instance, such as 163, two species were isolated from different portions of the intestine of the lamb. Two strains (141 and 152) were positively identified as belonging to the Escherichia genus, but beyond this the species was not determined.

The orienting carbohydrate tests with this class of aerobes recovered from the intestinal tubes of young lambs had shown in all cases both acid and gas produced from dextrose, maltose, xylose, arabinose, glycerin, galactose, levulose and mannite, whereas inulin was not fermented. Therefore, only the differentiating carbohydrates are shown in the table.

Discussion

Four groups of organisms were consistently encountered from the intestinal tube of the young shed lambs studied. Various species of the genus Escherichia and a Gram-positive microaerophilic diplococcus were present in each of the lambs. *C.*

welchii was isolated nearly as often, while *C. tertius* was identified in but two of the nine intestines.

Bacteriological studies of the intestinal tube of diseased shed lambs of about this age, originating from various other sections of the State, have been made for the past several years. The flora of the diseased lambs was limited to the same few groups found in the normal lambs. In view of these results, it may be concluded that the normal intestinal flora of young shed lambs is limited to very few genera with several species of Escherichia predominating.

Since the practices and methods used in shed-lambing throughout Montana are quite comparable to methods used in other states, it seems that in all probability the normal intestinal flora as described for the Montana shed lambs would be comparable to the flora of lambs born under similar conditions in other states.

The aerobic plating methods employed established the constancy with which the Escherichia genus was encountered and also the relative numbers of organisms of this genus in the various sections of the intestinal tube. The Gram-positive diplococcus possessed a low oxygen requirement, growing in the liquid anaerobic cultures, whereas it seldom appeared on the agar slants or plates. Thus the only growth occurring on the slants or plates was confined to the Gram-negative rods of the Escherichia genus. Hormone-agar slants and plates or Endo's agar plates were inoculated from each intestinal portion as indicated in table I. While the series of Endo's agar plates is not complete for every lamb, as are the hormone-agar slants and plates, still enough of each were used to establish the fact that no more aerobes grew on the hormone agar than upon the Endo's agar plates. Consequently the Endo's agar series represents the complete aerobic flora. For that reason, discussion concerning relative aerobic distribution in the four intestinal portions is

TABLE III—*Prevalence of aerobes in normal lamb's intestines*

LAMB	DISTRIBUTION OF ESCHERICHIA COLONIES ON ENDO'S AGAR PLATES			
	DUODENUM	JEJUNUM	ILEUM	CECUM
308	Few	Many	Many	Many
285	Few	Many	Many	Many
309	None	None	Many	Many
306	None	None	Many	Many
284	None	None	Few	Many
307	Few	Many	Many	Many

limited to the growth on this series of Endo's agar plates. Table III includes only the 1931 group of lambs cultured, since the cultures from these lambs were made by an exactly comparable method with as nearly as possible the same quantity of inoculum. This group of organisms was very scarce in the duodenum (duodenal cultures taken between pylorus and bile-duct) but more plentiful in the jejunum; while the ileum, cecum and colon contained a much greater number.

These results are partially confirmed by Dr. Dudley A. Gill,* of the Veterinary Laboratory of the Department of Agriculture, at Wallaceville, New Zealand. While working with diseased, three-week-old lambs, he states:

> Microscopically there appear to be plenty of mixed organisms present in the duodenum from the pylorus to the entrance of the bile-duct. From there to the commencement of the ileum it is rare to see any at all. In the ileum itself organisms begin to appear and are fairly numerous and of great variety in the final few inches before the cecum is reached.

The difference in age and the fact that Gill reports upon diseased lambs may be responsible for the contradictory findings in the duodenal and jejunal flora.

The results obtained from the brain medium and meat-piece liver-broth cultures establish *C. welchii* as the predominant anaerobe. A determination of the anaerobic count was not made. Gill,* working with the intestinal flora, found "no *C. welchii* in smears of the duodenum or jejunum. If a loopful of such contents were sown into a suitable liquid medium, a growth of what appeared to be *C. welchii* almost invariably occurred and probably arose from a few spores in the inoculum." In view of Gill's observations the development of *C. welchii* in anaerobic cultures in liquid media does not necessarily indicate that the organism was present in significant numbers.

During the course of this investigation it became essential to study in detail the various species of the genus Escherichia. This was done with the unknown strains isolated from the lambs reported upon in this paper. The various characteristics described in the third edition of Bergey's Manual of Determinative Bacteriology as typical for the different Escherichia species were determined for the organisms under consideration. Some fell directly into one species or another, yet several differed slightly from Bergey's description. For example, culture 308 most closely corresponded to *Escherichia communior* although gas was not produced from sucrose and salicin as should have been the case

*Unpublished report on "Lamb Mortality Investigation, 1930 Season."

with a typical communior strain. It would appear that slight vairiations of this kind should not be made the basis of specific differentiation. Consequently, this strain was considered an atypical *E. communior* rather than a distinct species.

SUMMARY

A bacteriological study was made of the duodenal, jejunal, ileac, cecal and colic portions of the intestinal tube of normal shed lambs in Montana during the 1930 and 1931 lambing seasons.

The ages of the nine lambs included in this study varied from fifteen to seventy-four hours. Only healthy lambs were used. Death was produced by chloroforming. Cultures were taken immediately after death.

The intestinal flora of very young lambs, within the first three days of life, included very few species and the same groups of organisms were present in all lambs.

All organisms encountered under aerobic cultivation on Endo's and hormone agar were of the genus Escherichia. In several instances two different species of Escherichia were identified from the intestine of the same lamb.

Under anaerobic methods of cultivation only three types of organisms developed. One of these, a micro-aerophilic Gram-positive diplococcus was present in all intestines. *C. welchii* occurred in one or more portions of the intestines in every case. *C. tertius* was found in two lambs.

With comparable dilutions and inoculum used in plating directly from the intestinal contents of six lambs in 1931, the results show the duodenum comparatively free of aerobes. More bacteria were found in the jejunum, and a still greater number were found in the ileum and cecum.

Psittacosis in California

During recent months there have been six deaths from psittacosis in California. The same number of non-fatal cases have been reported. Practically all of the twelve persons had been in contact with recently purchased parrakeets. The California Department of Public Health has made psittacosis a reportable disease and adopted a resolution restricting the movement of all birds of the parrot family and love birds. Dr. K. F. Meyer, of the Hooper Foundation for Medical Research, has been conducting the laboratory investigations of psittacosis in California.

PROGRESS IN CONTROLLING BOVINE TUBERCULOSIS*

By C. J. MARSHALL, *Philadelphia, Pa.*

School of Veterinary Medicine, University of Pennsylvania

That tuberculosis is infectious and can be transmitted experimentally was first demonstrated by Villemin, of France, in 1865. Many other celebrated scientists were soon able to confirm his findings. Three years later, Prof. Chauveaux, a French veterinarian, showed that the disease could be transmitted by way of the digestive tract and warned against the use of tuberculous meat as a food. Prof. Gerlach, a noted German veterinarian of Hanover, made similar observations.

Tuberculosis was not a new disease at that time. It has attracted much attention since the time of Moses. The sale of tuberculous meat was forbidden by the Church in portions of Germany in the ninth century and by law in Munich in 1370; in Prussia in 1394 and in several other places about that time.

The cause of the disease was not understood at the time of Villemin's celebrated discovery, nor for some years later, yet much work was done on this subject by numerous bacteriological workers. Some considered that there was a certain relationship between tuberculosis and syphilis. It was named "the French disease" by Florinus on account of the similarity of these two diseases. Virchow, one of the most noted pathologists of the nineteenth century, stated that tubercles in cattle were lymphosarcomata.

The next and most important event in the history of tuberculosis was the discovery of the cause of tuberculosis—the tubercle bacillus—by Robert Koch, of Germany, in 1882. His findings were soon confirmed by numerous bacteriologists and generally accepted by the most progressive physicians, veterinarians and sanitarians. This discovery created new interest in the disease. It was the general concensus of opinion that the prevention and cure of tuberculosis would soon follow. It was considered the same disease in all species of animals. For this reason tuberculosis in cattle was looked upon as a menace to the human family.

Robert Koch again startled the scientific world on August 4, 1890. He presented a paper on this date at a meeting of the

*Presented at the annual meeting of the Pennsylvania State Veterinary Medical Association, Harrisburg, Pa., October 22, 1931.

International Congress of Medicine in Berlin. He stated that he had found substances in cultures of the tubercle bacillus which were capable of rendering guinea pigs refractory to tuberculosis and of arresting the disease when it had reached an advanced stage. The substance was named "Koch's lymph" and later was called tuberculin.

For a short time following his discovery there were strong hopes that this remedy would prove a panacea for those afflicted with tuberculosis. Many tuberculous patients who could afford to do so went to Berlin for treatment. It did not take long to prove that the treatment, like many others, had its limitations. It was found that the treatment caused a fever reaction in tuberculous subjects. Veterinarians were not slow to take advantage of this effect and to use tuberculin as a diagnostic agent.

Tuberculin First Used in 1890

Tuberculin was first employed as a diagnostic agent on cattle by Prof. Gutmann, of the Veterinary Institute of Dorpat, Russia, in January, 1890, or about six months after Koch made his famous statement at the Berlin meeting. The test proved satisfactory. Unusual activity in tuberculin-testing followed rapidly in continental Europe. Keen opposition to its use soon developed. The technic and proper dose were not yet established. All kinds of syringes and doses were used. It is no wonder that confusion existed. Prior to February, 1892, Prof. A. Eber, a veterinary investigator of Berlin, collected statistics on 134 cattle that had reacted to the test and had been killed. He selected these animals from those that he considered had been properly tested, that is, where a proper dose had been used, temperature measurements correctly taken and recorded and autopsies made by reliable authority. Eber found that lesions had been reported in 85.82 per cent of the 134 animals. He made similar observations on 113 cattle that had passed a satisfactory test. No lesions were found in 89.38 per cent. The other showed lesions. His observations proved the reliability of tuberculin as a diagnostic agent.

Studies of the various phases of tuberculosis were not confined to researches in Europe. Dr. Samuel G. Dixon, who was later Health Commissioner of Pennsylvania, was among the early tuberculosis investigators in America. His work was done at the Academy of Natural Science in Philadelphia. He called attention to the presence of a toxic substance produced by grow-

ing colonies of tubercle bacilli. His observations were reported in *The Medical News* of October, 1889, and later he published an article in *The Times Register*, in which he stated that cases of latent, localized tuberculous lesions became rapidly generalized after injections of large doses of tuberculin (See Friedberger and Frohner's "Pathology and Therapeutics of Domestic Animals," vol. II, page 479, translated by W. L. Zuill, and published in 1895).

Dixon took a decided stand against tuberculin as a diagnostic agent and evidently never changed his mind. In later years, while Health Commissioner of Pennsylvania, he owned a herd that was known to be tuberculous, yet he would not submit it to the tuberculin test.

W. L. Zuill, M. D., D. V. S., Professor of Veterinary Surgery, University of Pennsylvania, was of the same opinion as Dr. Dixon. Dr. Zuill also was a member of the Academy of Natural Sciences and worked with Dr. Dixon on the subject of tuberculosis. In studying tuberculin, Dixon had produced a crystalline substance that he considered belonged to the amido group of chemicals. He and Dr. Zuill made an unsuccessful attempt to show that a reaction similar to that obtained with tuberculin could be produced in a tuberculous animal with such members of the group as allantoin, glycocin, tyrosin, kreatin, creatinin, taurin, cystin, etc. This work was done before 1892 (F. & F., vol. II, page 460).

A Study of Tuberculin Planned

A project was outlined by Dr. Zuill and a committee organized at the University of Pennsylvania for studying tuberculin and its various uses. The project was published in the May, 1891, issue of *The American Veterinary Review* (vol. 15, p. 59). No record has been found of the results obtained. It is evident that they failed to make much of an impression on Dr. Zuill. In his translation of Friedberger and Frohner, numerous references are made to the work of Dr. Dixon. Very little credit is given tuberculin as a diagnostic agent and no mention is made of the committee. Numerous objections to the use of tuberculin are mentioned in the text of his translation of F. & F. It is stated that "in the hands of Kitt, Lothes, Gensert, Schwarz, Arloing and Hutyra, all noted foreign scientists, tuberculin has shown tself unreliable and irregular in its effects."

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Such was the status of the knowledge of tuberculosis and tuberculin when Leonard Pearson, a young man 23 years of age, returned from Germany in the winter of 1891 and 1892. He already had a B. S. degree from Cornell and V. M. D. from the University of Pennsylvania and had spent some time with several tuberculosis workers abroad, including Koch.

Pearson was promptly appointed Assistant Professor of Veterinary Medicine at the University. The work done abroad with tuberculin and that done by Dixon and Zuill at home was well known to him. In spite of the somewhat chaotic state of the knowledge existing in regard to the value of tuberculin and the conflicting opinions prevailing abroad and at home, he was the first in America to recognize its value and recommend its use.

An Epochal Event

In February, 1892, he recommended and used the tuberculin test on the Clairmont Farm herd of Jerseys, at Villa Nova, Pa. This herd, consisting of 79 head, considered one of the best in the country, belonged to Mr. Joseph Gillingham, a trustee of the University of Pennsylvania. Thirty-three animals failed to pass the test. All were slaughtered and lesions, more or less extensive, were found in every one. An account of this test was published by Pearson, in May, 1892, in *Agricultural Science*, vol. VI, page 254.

Many noted men were present at the slaughter of these that failed to pass the test. On March 26, 1892, Dr. Gould published an editorial in *Medical News*, in which he pointed out the great value of the tuberculin test and called attention to the necessity for legislation looking to the general introduction of this test for the control of the disease in cattle. Remarks made by Drs. Pearson, John Guiteras, E. D. Shakspear and A. C. Abbott, in reference to the slaughter and autopsy findings on the reactors of the Clairmont herd and the value of the tuberculin test to science, were published in the same issue of *Medical News* above mentioned. The Philadelphia *Public Ledger*, March 17, 1892, published an excellent article descriptive of this test and slaughter.

The following quotation from an article written by Pearson, May 16, 1892, and published in *Agricultural Science*, vol. VI, will show the wonderful foresight he had at that time:

> The disease can be checked, and some day measures for its suppression will surely be inaugurated. By commencing now, much expense, much misery and suffering can be avoided. Certainly the herds supplying the cities with milk should be regularly inspected and tuberculous animals

removed from them. Since the destruction of an animal suffering from tuberculosis is for the good of the public, the animal should be paid for out of public funds, and a generous appropriation should be made for this purpose by every state legislature. Concealments of facts of knowingly selling the milk from a tuberculous cow should be a punishable offense.

The test on the Clairmont herd attracted much attention from physicians, veterinarians, sanitarians, breeders and dairymen. Not a few intelligent men considered Pearson an enthusiastic dreamer and thought Mr. Gillingham was foolish to sacrifice so many valuable animals. It has been stated upon good authority that Mr. Gillingham was so informed by Dr. Dixon, before the reacting cattle were slaughtered. Pearson stated at the time that the gain to science from the broad-mindedness displayed by Mr. Gillingham was very material and if the addition to our knowledge should be a step leading up to the passage of efficient laws relating to tuberculosis, the sacrifice would be a blessing to every cattle-breeder and consumer of cattle products in the United States.

Marvelous Progress Recorded

It has been forty years since Pearson made this statement. The progress made in this country in controlling tuberculosis in man and animals has been marvelous. It has exceeded the fondest expectations of those familiar with the disease. The work is now going forward with speed and efficiency in nearly every state in the Union. At the present time 39 counties in Pennsylvania are in what is known as Modified Accredited Area, which means that tuberculosis has been reduced in these counties to less than one-half of one per cent. More than 80,000 head of cattle in 8,223 herds were tested for tuberculosis by the Pennsylvania Bureau of Animal Industry during the month of August of this year. Over 85 per cent of the cattle in Pennsylvania are now under state and federal supervision in the drive to eliminate tuberculosis.

The following is quoted from the *Weekly News Bulletin*, Pennsylvania Department of Agriculture, October 15, 1931:

> More than 30,400,000 cattle throughout the United States are now under supervision in the control of bovine tuberculosis, according to a report from the federal government. Tested cattle are being added to the list at the rate of approximately 200,000 per month.

Other significant facts taken from the report are:

> Testing on an area basis has progressed to a point where live stock owners and veterinarians have practically eliminated the disease from more than 40 per cent of all the counties in the United States.

The degree of infection for the entire country has been reduced more than half. Many counties that formerly had 25 per cent or more of infection, have been cleaned up.

Four states have been officially designated as modified accredited areas, signifying the practical elimination of the disease. These are Maine, North Carolina, Michigan and Indiana. Four other states, Ohio, Idaho, Wisconsin and North Dakota, have reduced the per cent of infection to a very low degree, and are expected to qualify for complete accreditation within a year.*

There is little doubt but that within the next ten years most states will be declared free from bovine tuberculosis by the federal government.

We should not forget the pioneer work done by Pearson. He soon developed a large private practice and carried on his work at the Veterinary School as Assistant Professor of Veterinary Medicine, later as Professor of Veterinary Medicine, and then as Dean. He obtained the money from the State to erect the Veterinary School buildings and provide equipment for one of the most complete veterinary schools in this country. In addition to this stupendous work, he was instrumental in getting suitable laws passed and in organizing the State Live Stock Sanitary Board. He served as State Veterinarian for 14 years.

He not only introduced the tuberculin test in America but had more to do with making it of practical value to the live stock industry than any one man in the whole world. It is used abroad and is greatly appreciated for its accuracy, yet the disease is considered more prevalent today in most foreign countries than it was in 1892.

Early Work Encountered Opposition

Pearson has no easy task in making the test practicable in America. Many of the best veterinarians were opposed to it or were merely luke warm. Certain ones who became enthused with tuberculosis eradication work and tried to assist in making the tuberculin test popular, provoked many of their best clients and lost prestige and practice by so doing. Breeders as a class were opposed to it. There was now and then a progressive herd-owner who solicited a test. Pearson tested many of the best herds in America from 1892 to 1895. Such tests were made at the expense of the owners, reactors were slaughtered and no indemnity was received. The entire carcass was buried or made into fertilizer. It was due to Pearson's foresight and efforts that suitable laws were placed upon the statute books and funds provided for controlling tuberculosis. A plan was soon worked out

*Ohio and Wisconsin became modified accredited areas, January 1, 1932.—Editor.

by him for having reacting cattle appraised, killed under official supervision, and the meat, if considered suitable, used for food. The International Veterinary Congress which met at Brussels, in 1885, recommended that the rejection of all meat coming from tuberculous animals is extreme. Pearson accepted this opinion fully and was the first to advocate and to put in practice the salvaging of the meat of reactors for human food. This plan was soon put into general operation through the country. The amount of money saved by this plan has been enormous.

One of Pearson's first activities after having been appointed State Veterinarian was the establishment of a diagnostic and research laboratory. This was the first of its kind in veterinary medicine in any of the states. No one feature of the excellent organization of the Pennsylvania Bureau of Animal Industry as it exists today has accomplished more for the veterinary profession and the live stock industry than the laboratory has. The efficient work done by the laboratory from the time of its inception to the present time is too well known to require comment.

During Pearson's day the tuberculin test was a voluntary act upon the part of the herd-owner. Force was never used except upon interstate shipments, yet much testing was done voluntarily. Since 1895, there has never been a time when there was not a good-sized waiting-list of applications filed for a test. They have received attention as fast as funds would permit.

The Pennsylvania Plan

Pearson designated this plan of handling tuberculosis as the "Pennsylvania Plan." It was based on the voluntary tuberculin test, the elimination of the reactors, and sanitation. It provided for the issuing of certificates by the Pennsylvania State Live Stock Sanitary Board to owners of herds which had passed tuberculin tests. A number of such certificates were issued and renewed thereafter. It was copied and followed by numerous other states. It should be known as the "Pearson Plan."

The principles of the Pennsylvania Plan are the basis and it was thus the foundation of the present Individual Uniform Accredited Herd and Modified Area plans now being used by the various state and federal governments in the coöperative tuberculosis eradication work.

Several other plans were advocated outside of Pennsylvania and received much publicity and favorable comment. Yet none have stood the test of time as compared with the Pearson Plan.

Those referred to are known as the "Bang Plan," the "Ostertag Plan," and the "Manchester Plan." No remarkable progress has yet been made by any of them as far as exterminating tuberculosis is concerned. Pearson gave them a fair and unbiased trial but found they could not meet conditions in this country.

Since the discovery of the tubercle bacillus, it has been the dream of bacteriologists to find a product that would prevent tuberculosis. Von Behring, of Germany, was among the first to announce such a discovery. He did a lot of excellent work on the subject. Pearson was one of the first to show that his method was not satisfactory. Pearson had certain hopes that a satisfactory method of preventive vaccination might be discovered. He outlined and conducted an extensive investigation on the use of the human type of tubercle bacilli as a preventive for bovine tuberculosis. He knew that the human type had but little if any virulence for bovines. His work, which extended over several years, was watched with much interest by scientists in the United States and foreign countries. He was somewhat disappointed with the results obtained yet not discouraged. Failure, according to his ideas, did not exist in properly conducted research. The negative as well as the positive has its value. Much research on the subject of preventive vaccination has been conducted since his work was finished. The problem is not yet solved. Considerable has been heard recently about the *B. C. G.* method of vaccination. It consists of using the bovine type of tubercle bacillus which has been attenuated by the use of ox-gall in the culture medium. It was brought fourth by Calmette and Guérin, two French scientists connected with the Pasteur Institute. It was looked upon with some favor by the International Veterinary Congress which met in London last year. The American methods in use up to the present time for controlling tuberculosis are considered too extravagant and wasteful for European conditions. If vaccination should be perfected to a point hoped for, it remains to be demonstrated whether it will be less expensive or more sure in its results than the tuberculin test has already been so well demonstrated to be with tuberculosis in this country.

Dyson Accredited Herd Plan

The adoption of a uniform and coöperative plan between the states and the federal government was first proposed by Dr. O. E. Dyson, state veterinarian of Illinois. It provided for several classes of herds, as A, B and C, according to their tuberculosis

health status. Dr. Dyson presented his plan at a meeting of the U. S. Live Stock Sanitary Association, in Chicago, December, 1914. It was favorably received and considered by those present. In justice to Dr. Dyson this should be known as the "Dyson Accredited Herd Plan." It was, as stated, the first step towards the "Federal-State Accredited Herd Plan."

After some modification and changes it was finally adopted in December, 1917, by the U. S. Live Stock Sanitary Association as the uniform (Plan) methods and rules governing coöperative state and federal accredited herds. Out of this last mentioned plan sprang the present Modified Area Plan, which was adopted by the U. S. Live Stock Sanitary Association, in December, 1922.

Pearson's activities were not confined to tuberculosis. He accomplished much in other lines for the live stock industry, for sanitary science, for the University of Pennsylvania Veterinary School, for veterinary education, and for the veterinary and medical professions. He had confidence in the tuberculin test from the first, worked with it and for it on all occasions and was able to transmit his confidence and enthusiasm to others. His pioneer work in tuberculosis eradication should stand as a monument to his memory.

Veterinarians

Columbus has as its guests these days the veterinarians of the state. To many city people veterinarians are individuals who chloroform old cats and treat dogs after they have been hit by automobiles. While this is a valuable service to the owners of these animals, city people as a rule do not appreciate the importance of the veterinary medical profession. In rural districts veterinarians are looked upon as the aristocracy of agriculture. In many instances they mean the difference between prosperity and poverty for the farmers, between good, slick and healthy live stock and no live stock at all. And, too, although the D. V. M. does not directly maintain the health of human beings like a doctor of medicine, indirectly he is an asset to human welfare by his prevention, control and elimination of many diseases among animals which might and upon occasion do affect humans. In this utilitarian age a man's worth is decided by the service he gives to his fellows, and by that measurement the veterinarian is one of the most valuable assets of the farming districts.

Editorial in Columbus (O.) *State-Journal.*

A NOTE ON THE KEEPING QUALITY OF SALMONELLA PULLORUM ANTIGEN*

By JACOB BIELY, *Vancouver, Canada*

The University of British Columbia

The purpose of this note is to report on the keeping qualities of *Salmonella pullorum* antigen (rapid method) held at ice-box temperature for over three years, as compared with freshly prepared antigens.

METHOD AND TECHNIC

Both old and new antigens were prepared from four *S. pullorum* strains originally obtained about 1919 from the Veterinary Division of the Massachusetts Agricultural College. The cultures were grown on plain nutrient agar to which was added 0.5 per cent peptone (pH 7.0—7.2). They were incubated about 48 hours at 37°C. The growth was washed off with distilled water containing 12 per cent NaCl C. P. and 0.5 per cent phenol C. P. The antigen was standardized to fifty times the turbidity of .75 tube on the McFarland nephelometer. The pH was approximately 7.8—8.0.

In making the dilutions, 0.04 and 0.02 cc of serum were measured out on a glass plate ruled in 1½-inch squares; 0.2 cc of antigen was added to the respective quantities of serum and stirred with a tooth-pick. The tests were incubated for five minutes at 37°C., and readings were made at five and eight minutes, respectively. In making a diagnosis consideration was given to the degree of reaction and the time required for the reaction to occur. Further details in connection with the preparation of the antigen and technic of testing were reported in a previous paper.[1]

EXPERIMENTAL DATA

About 1100 blood samples were tested with the two new lots of antigen. After the readings had been made, all the positive and suspicious blood samples were segregated and set at random among a large number of the remaining negative blood samples. These samples were then retested with the old lot of antigen and the results recorded in a separate book. On completion of the experiment the results were compared and summarized in table I.

*Grant from Canadian National Research Council. Received for publication, October 31, 1931.

TABLE I—*Comparison of the efficiency of fresh and old antigens.*

GROUP	TOTAL	ANTIGEN								
		7 DAYS OLD[1]			1 DAY OLD[2]			OLD[3]		
		N	P	S	N	P	S	N	P	S
I	57	47	6	4				45	7	5
II	51	36	15	0				36	15	0
III	57	22	34	1				22	32	3
IV	114				105	8	1	105	8	1
V	57				52	5	0	52	5	0
		105	55	5	157	13	1			
Grand totals					262	68	6	260	67	9

N Negative.
P Positive.
S Suspicious.

[1]Prepared September 3, 1931.
[2]Prepared September 15, 1931.
[3]Prepared March 28, 1928.

It will be seen that, with the seven-day-old antigen, out of a total of 165 blood samples, there were 105 negative, 55 positive and 5 suspicious reactors, and that with the old antigen there were 103 negative, 54 positive and 8 suspicious reactors. There was perfect agreement between the day-old antigen and the three-year-old antigen.

The difference in diagnosis between the two fresh lots of antigen and the old lot of antigen is practically negligible, indicating that the old antigen was as sensitive as the fresh lots of antigen. This is especially brought out in the case of the suspicious reactors, since the same birds reacted suspiciously to both the old batch and the two fresh lots of antigen. The apparent difference between the positive and negative reactions of the seven-day-old and the old antigen is very likely due to some slight error in technic, rather than to difference in sensitivity of the two lots of antigen.

In routine work antigens kept from six months to one year have not shown any diminishing sensitiveness when compared with fresh lots of antigen, unless the former were obviously contaminated.

DISCUSSION

The preparation and standardization of antigens for the rapid-method agglutination is fraught with considerable difficulty, since it is necessary to harvest a large crop of bacteria in order to prepare an emulsion fifty times as thick as the one used for the standard tube agglutination test. Since each lot of antigen has to be checked with positive and negative sera and carefully

standardized as to density, sensitiveness of reaction, etc., it is more convenient to prepare a large lot of stock antigen at one time. Large quantities of antigen prepared and checked under most rigid laboratory conditions would serve to insure more uniform and standard methods of testing, if used continuously in one or in several laboratories. That such antigens will keep, without appreciable loss of sensitivity, is demonstrated by the data reported in this paper.

SUMMARY

An antigen prepared March 28, 1928 (three years and seven months old), and kept since at ice-box temperature, has been found to be as senstiive for the detection of *S. pullorum* carriers as two fresh lots of antigen seven days and one day old respectively. The old and new antigens were prepared by the same method and the same technic was used in the diagnosis of the sera.

REFERENCE

[1]Biely, J., Sawyer, C. E., Hamilton, C. M., Johnson, W. T., and Dickinson, E. M.: Accuracy of three coöperating laboratories in detecting pullorum disease by the agglutination test. Jour. A. V. M. A., lxxix (1931), n. s. 32 (1), pp. 19-36.

Meat Inspection Established

Largely through the efforts of Dr. E. D. Wineland, deputy state veterinarian of Arkansas, city meat inspection has been established at Booneville, Ark. The work will be carried on under the supervision of Dr. Wineland, according to information received from Dr. Joe H. Bux, State Veterinarian.

Prizes for Four-H Club Boys

The Arkansas Veterinary Medical Association is offering fifty dollars in prizes for the best essays on the subject of "The Advantages of the Veterinary Profession," written by Four-H Club boys. The Agricultural Extension Division of the Arkansas Agricultural College is coöperating in the project.

STATE BOARD EXAMINATION

Massachusetts Board of Registration in Veterinary Medicine. State House, Boston, Mass. June 28-29, 1932. Dr. E. W. Babson, Secretary, Gloucester, Mass.

AORTIC THROMBOSIS IN A DOG*

By FRED R. HARPER, *Rochester, Minnesota*
Fellow in Surgery, The Mayo Foundation

In this case of aortic thrombosis in a dog, there were no demonstrable lesions to account for the vascular accident. The relative rarity of reports of thrombosis and embolism in veterinary literature, as compared with the frequency of occurrence of these lesions in man, would appear to justify the report of this case.

Joest[7] emphasized the rarity of all types of thrombosis and embolism in dogs. Ball[1] reported a case of aortic thrombosis in a dog, aged eleven years. In his case there was associated chronic atheromatous aortitis. Coquot and Leblois[3] reported a case of thrombosis of the external iliac and hypogastric arteries in a dog, also aged eleven years. Virchow[10] did the first important work on embolism and thrombosis. Welch[11] reviewed the subject thoroughly in 1910, and noted fifty-nine cases in the literature. Banowitch and Ira[2] brought the number up to 110, in 1928. In 1930, cases were reported by Hamilton,[5] by Eddie,[4] and by Held and Goldbloom.[6] Mann[8] used paraffin and the animal's own blood to produce experimental pulmonary embolism in the dog. He found that death would not occur unless the pulmonary circulation was practically occluded.

REPORT OF CASE

A male bull terrier, the age of which was not accurately known, was received in the laboratory in the autumn of 1923, and in November of that year was the recipient of a transplant of infectious sarcoma of the dog. The transplant did not survive. In the ensuing years the animal was used in several investigations. The procedures employed in these investigations should not have been the cause of or contributing factors to the develop-

*Work done in the Division of Experimental Surgery and Pathology. Submitted for publication, December 30, 1931.

ment of thrombosis. In June, 1931, a gastric fistula was made. Recovery was uneventful. August 4, 1931, a gastric pouch was made from the fundus of the stomach, so that it drained through the fistula which had been previously established. Convalescence was uneventful until August 19, 1931, fourteen days after operation. At that time, the dog had been taken from his kennel and was running around, apparently in good condition, when he suddenly collapsed and cried out. Almost immediately both hind legs were completely paralyzed. At intervals of ten to fifteen minutes, for several hours, the dog would thrash around in his kennel and cry out. In the intervals between these acute attacks he would be fairly quiet. After the first attack the lower

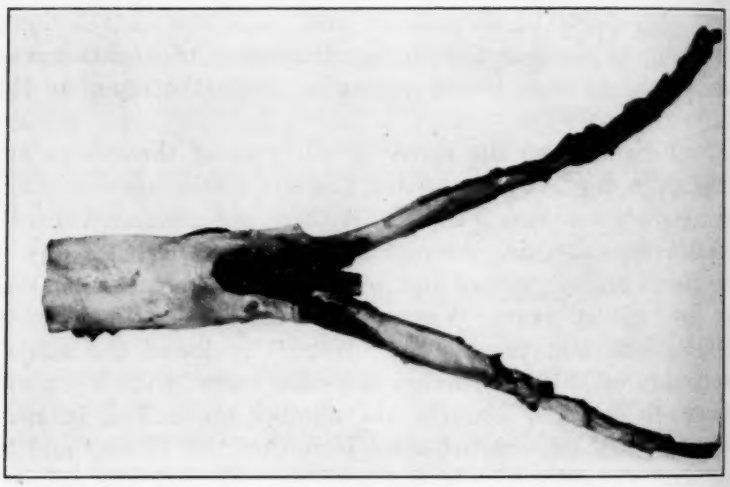

Fig. 1. Clot lodged at the bifurcation of the aorta and extending down both common iliac arteries.

extremities became cold, pulsations were absent, and the animal became incontinent of urine. The following morning the glans penis sloughed away. Death occurred twenty-eight hours after the onset.

At necropsy, the lungs, heart, peritoneal cavity and spinal cord were normal. On opening the abdominal aorta a large, firm, saddle-shaped blood clot was found filling the vessel at its bifurcation. This clot extended about 2 cm. into the aorta and down both common iliac arteries for about 5 cm. (fig. 1). The clot was somewhat adherent but was easily removed.

Microscopic examination disclosed signs of some organization indicative of an antemortem blood clot, but absence of fibro-

blastic proliferation was evidence that it had formed only a few days before death (fig. 2). In the aorta a moderate degree of arteriosclerosis, and thickening of the intima were observed, but there was no evidence of aortitis (fig. 3).

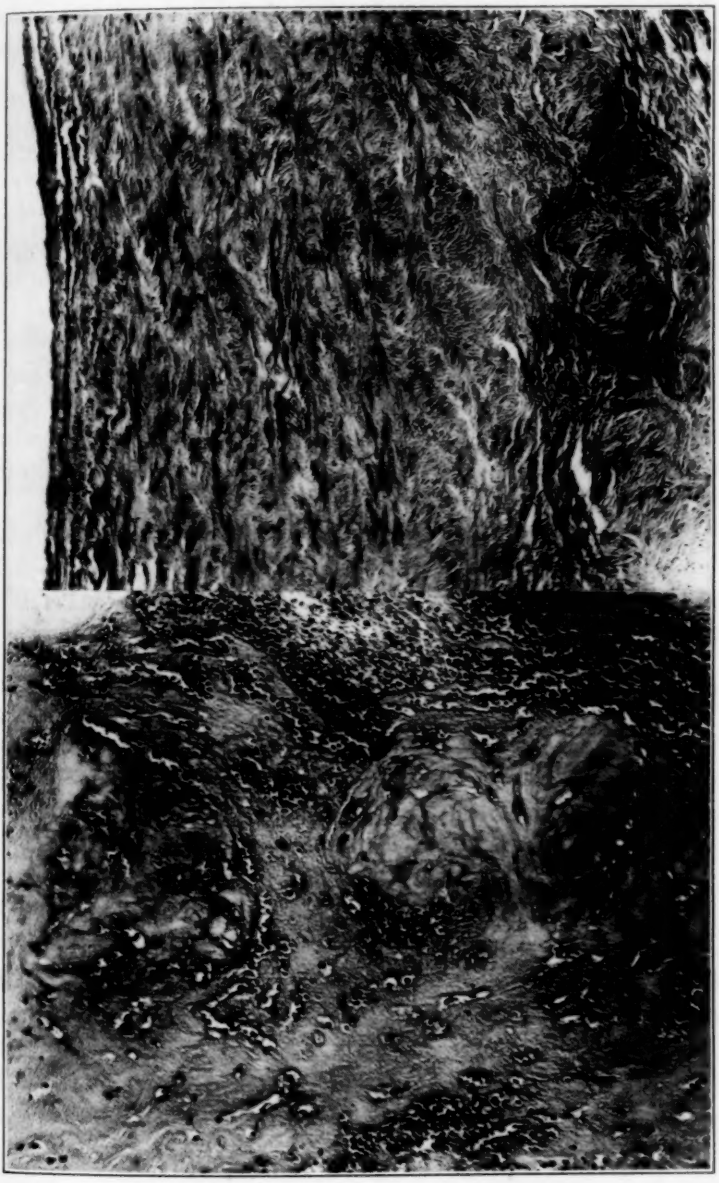

Fig. 2 (above). Section through the clot.
Fig. 3 (below). Longitudinal section of the aorta.

Comment

In any case of occlusion of the aorta by a blood clot, it is difficult to determine whether embolism or thrombosis is the cause. Wylde[12] felt that in man, embolism was more common, in the proportion of about 3 to 1. Osler[9] pointed out that most cases of aortic thrombosis were associated with disease of the wall of the vessel, usually arteriosclerosis, whereas cases of embolism were generally associated with mitral stenosis.

This animal had the typical signs of aortic occlusion, namely, paroxysmal pain, paralysis of the lower extremities, incontinence of urine, absence of pulsation in and coldness of the lower extremities without edema, and eventually gangrene resulting in sloughing of the glans penis. The heart and lungs were normal, and there was no evidence of the primary situation of the clot. On the other hand, the dog was more than eight years old, which age might be compared to fifty-five or sixty in man. In the aorta there was a corresponding amount of sclerosis. In view of these facts, this seemed to be a case in which an aortic thrombus formed in the aorta or in an auricular appendage. It is doubtful if the last operation was of etiologic significance.

It is thought by Welch and others that the paraplegia following embolism or thrombosis of the abdominal aorta in human beings is not caused by ischemia of the spinal cord. The spinal cord of this animal was normal.

Summary

A case of aortic thrombosis in a dog is reported. Absence of pathologic change in the heart or lungs, and the finding of arteriosclerosis in an animal of advanced age, indicate that the case was one of thrombosis rather than of embolism.

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SUSCEPTIBILITY OF CHICKENS TO BRUCELLIASIS*

By HENRY VAN ROEKEL, K. L. BULLIS, O. S. FLINT *and* MARIAM K. CLARKE

Department of Veterinary Science, Massachusetts Agricultural Experiment Station, Amherst, Mass.

Since natural outbreaks of *Brucella abortus* infection among chickens have been reported to occur in other sections of this country, it was deemed advisable to determine whether this disease is present among chickens in Massachusetts.

The tube agglutination test was employed to detect birds that had been exposed to the infection. Two dilutions (1:25 and 1:50) were used. All tests were incubated for 24 hours at 37°C. and those tests showing doubtful reactions were incubated an additional 24 hours. Known positive and negative sera were tested for controls.

Chickens were tested in approximately every county in the State. A total of 25,202 birds, representing 53 flocks, was tested. The chicken population for these flocks was 70,479 birds. No reactors were found among the birds tested. Thirty flock-owners had other live stock on the premises and nine permitted the chickens to come in contact with the live stock. Three owners had their cattle tested for *Br. abortus* infection and reactors were found in two of the herds. The chickens were not permitted to come in contact with the cattle in the three herds.

Laboratory experiments, to produce the infection in chickens by feeding and by intraperitoneal and intravenous inoculations, were attempted.

Two hens were given 12 feedings of a saline suspension of the organism during a period of 17 days and agglutinins were detected 16 days after the first feeding. However, at no time were agglutinins well established in the blood-stream and the titre began to decrease two weeks after agglutinins were first detected. The birds were killed 28 days after the first feeding. Pathological and bacteriological findings were negative.

Two hens were given three intraperitoneal inoculations with a saline suspension of the organism. Agglutinins were detected seven days after the first inoculation and a strong titre had been established at four weeks. At the end of seven weeks, the birds were killed and no pathological and bacteriological evidences of infection were observed.

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Two males were given nine intraperitoneal inoculations with a saline suspension of the organism. Inappetence, somnolence, ruffled feathers, and decrease in body weight were observed. Agglutinins were present in the blood-stream nine days after the first feeding. Necropsies were performed 20 days after the first feeding and *Br. abortus* was recovered from both individuals.

One male was given three intravenous inoculations with a saline suspension of the organism. Clinical symptoms were observed. Agglutinins were established in the blood-stream between the 4th and 19th days after the first inoculation. A necropsy was performed on the 19th day and *Br. abortus* recovered.

These observations show that natural Brucella infection in chickens in Massachusetts appears to be of little, if any, significance. Agglutinins were produced when birds were fed and inoculated with saline suspensions of the organism. Repeated doses of the antigen were tolerated without producing death.

DIAPHRAGMATIC HERNIA IN A CAT

By C. J. KERSHAW, *Detroit, Mich.*

Michigan Humane Society

Subject: Aged male cat.

History: Present owner has had cat two years; previous history unknown. During these two years, the cat has had irregular attacks of dyspnea with cyanosis. These attacks came on suddenly, with any excitement or exertion, and passed off upon rest and quiet.

Examination showed dullness over the thoracic cavity. On palpation the thoracic cavity felt abnormally solid and no chest expansion could be detected. Otherwise, the cat lived a normal life. He was found dead one morning after having eaten well and appearing normal the night before.

Autopsy: An opening about one inch in diameter was found in the lower diaphragm. There was no attachment of the diaphragm to the sternum. The abdominal cavity contained only the stomach, two lobes of the liver and about four inches of the colon. The entire small intestine and the balance of the liver and colon were in the thoracic cavity. The left lung was about one-eighth normal size and the right lung about one-fourth normal size. There was no evidence of injury. The appearance of the hernial opening and the history would indicate abnormality of long standing, perhaps congenital.

SOME OBSERVATIONS ON THE DISTRIBUTION OF VIRUS IN THE BODY OF BIRDS AFFECTED WITH INFECTIOUS BRONCHITIS, WITH SPECIAL REFERENCE TO THE CARRIER STATE. A. Komarov and F. R. Beaudette. Abst. Poultry Science, x (1931), 7, p. 391.

In an examination of 658 birds it was not possible to demonstrate the virus of infectious bronchitis in the liver, spleen, kidney, ovary or peripheral blood. Material was taken during the incubation period, at the height of the disease, and after death. By means of direct swabbing from recovered to healthy birds, carriers of the virus were determined in a population 43 days after the outbreak. After another month, 6 of 8 recovered birds continued to carry the virus. Finally, in a population of 25 birds which had infectious bronchitis 16 months previously, 3 carriers of the virus were determined.

A TYPE OF NUTRITIONAL LEG-WEAKNESS AFFECTING CHICKS. R. M. Bethke, P. H. Record and D. C. Kennard. Poultry Science, x (1931), 7, p. 355.

Dried skim-milk, dried buttermilk, dried whey, a milk concentrate, good quality alfalfa leaf meal and autoclaved yeast proved effective in preventing a type of paralysis affecting the legs and feet of growing chicks. Wheat middlings (20 per cent), carrying the major portion of the germ, and wheat germ (10 per cent) gave increased growth, but were ineffective in preventing the paralysis. The paralysis was found to be distinctly different from rickets, hock-joint disease (slipped tendon) and the "crazy chick" disorder.

FURTHER STUDIES IN ANTIRABIES IMMUNIZATION. Rabies virus-exalted and classical strains compared. G. Stuart and K. S. Krikorian. Jour. Hyg., xxxi (1931), 4, p. 523.

The occurrence of an exalted strain of rabies virus has been recorded and a definition given of *virus de rue renforce*. The

latter should be defined as a naturally exalted street virus, characterized by a high degree of infectivity, by abnormally short incubation period and duration of illness, by complete mutation or fixation at the first passage in rabbits and by a behavior thereafter in all respects akin to fixed virus. A classification of street virus strains has been suggested. Cross-immunity experiments have been carried out and as a result of cross-protection tests and of crossed-serum reactions identity of exalted virus with the classical strains has been established. The employment of autogenous and polyvalent vaccines has been shown to be unnecessary in antirabies immunization.

THE INFLUENCE OF ENVIRONMENTAL TEMPERATURE ON THE MORTALITY IN CHICKS INOCULATED WITH THE VIRUS OF INFECTIOUS BRONCHITIS. C. B. Hudson. Abst. Poultry Science, x (1931), 7, p. 391.

In a series of 6 experiments in which 298 birds were used, 150 were inoculated with infectious bronchitis virus and held at room temperature (16 to 22° C.) and 148 were similarly inoculated and held, with one exception, at 37 to 39° C. The mortality in the groups held at room temperature was 60 per cent, as compared with a mortality of 32 per cent in the groups held at the higher temperature. In one experiment it was not possible to reach the high temperature so that in a population of 91 birds there was a loss of 40.65 per cent, as compared with a loss of 58.06 per cent in the 93 controls held at room temperature.

ADSORPTION OF TUBERCULIN BY COAL DUST. S. Lyle Cummins and C. Weatherall. Jour. Hyg., xxxi (1931), 4, p. 464.

Anthracite coal dust is capable of adsorping the active principle of tuberculin. This power of adsorption is especially well marked when the contact between the coal dust and the tuberculin is brought about in a slightly alkaline medium. Previous saturation with serum proteid, while it appears to diminish, does not annul the power of coal dust to adsorb the active principle of tuberculin.

FILTRATION OF THE VIRUS OF FOOT-AND-MOUTH DISEASE THROUGH A NEW SERIES OF GRADED COLLODION MEMBRANES. I. A. Galloway and W. J. Elford. Brit. Jour. Exp. Path., xii (1931), 6, p. 407.

The virus of foot-and-mouth disease in broth medium has passed through all graded collodion membranes of an average

pore diameter greater than 25 millimicrons and is effectively retained below this limit of permeability. The size of the virus has been estimated to be 8-12 millimicrons and has been shown to be intermediate between that of bacteriophage (coli) and oxyhemoglobin. The influence of medium, variation in membrane thickness and concentration of virus, and applied filtration pressure upon the course of filtration are discussed. The variation of pH over the range 6.40-8.75, within which the virus is stable, has had no appreciable effect on the filtration of the virus of foot-and-mouth disease.

Some Data Concerning the Infectivity, Survival, and Powers of Diffusion of the Virus of "Louping Ill." J. Czarkowsha-Gladney and E. Weston Hurst. Brit. Jour. Exp. Path., xii (1931), 6, p. 426.

On progressive dilution of a 1 per cent filtrate, infection may still be obtained by the intracerebral inoculation of a strength of 1/1,000,000 and sometimes with 1/10,000,000. In the storage of infective filtrates, the presence or absence of oxygen makes little difference on the survival of the virus. The periods of survival of the virus at different temperatures have been ascertained. Figures for the survival of virus in pieces of brain tissue kept in Petri dishes at various temperatures or in glycerin in the cold room have been determined. Clear evidence of the ability of the virus to diffuse into liquid media has been obtained.

Early Cellular Reaction to Tubercle Bacilli: A Comparison of This Reaction in Normal and Tuberculous Guinea Pigs and in Guinea Pigs Immunized with Dead Bacilli. Esmond R. Long, Arthur J. Vorwald and Lilian Donaldson. Arch. Path., xii (1931), 6, p. 956.

Prompt localization of tubercle bacilli is brought about by exudation of polymorphonuclear leucocytes and phagocytosis of the bacilli by these cells. Although the bacteria are at first widely spread and the initial polymorphonuclear reaction is correspondingly diffuse, aggregations of leucocytes, containing all of the bacilli injected, into distinct and separate foci, soon occur. The polymorphonuclears are soon replaced by large mononuclears, which, as shown by many other investigators, later develop into epithelioid cells with more abundant cytoplasm. It appears that the large mononuclear cells concerned in the reaction came

directly from the blood-stream and were not derived locally. Already present tubercle bacilli in an animal greatly accelerate the reacting capacity of the polymorphonuclear leucocytes. This is looked upon as simply one feature of a typical tuberculin reaction. Previous inoculation with dead bacilli brings about a similar allergic state, although the acceleration and increased intensity of the inflammatory reaction over that seen in the normal animal are not nearly so great as in the truly tuberculous animal.

Mast Myelocyte Leukemia in a Cat. R. D. Lillie. Amer. Jour. Path., vii (1931), 6, p. 713.

A case of mast myelocyte leukemia in a cat is reported. Of some twelve reported or mentioned cases of leukemia in cats this is the fourth to be recorded as splenic or myelogenous and the first in cats in which basophilic myelocytes have been the predominating cell type. Anatomically this case presented an enormous enlargement of the spleen, enlargement of the liver, extensive mast myelocyte infiltration of the splenic pulp, mast myelocyte nodules in the liver and distention of liver capillaries by blood and large numbers of mast myelocytes. Numbers of mast myelocytes were seen in hepatic and renal veins. The blood, lymph-glands and bone-marrow were not examined.

Pulmonary Asbestosis in a Dog. Norah H. Schuster. Jour. Path. and Bact., xxxiv (1931), 6, p. 751.

The lungs of a dog suffering from asbestosis are described. The histology is typical, but naked asbestos fibers are present instead of the asbestos "bodies" usually found, and the case therefore throws no direct light on the mode of formation of these bodies. Asbestos "bodies" do not alter the course or nature of the disease. The fibrosis is probably a result of the toxic action of the asbestos, a combined silicate, and not a mechanical effect.

Lethal Temperatures for Porcine Strains of Brucella Abortus with Special Reference to Pasteurization. Ruth A. Boak and C. M. Carpenter. Jour. Inf. Dis., ixl (1931), 6, p. 485.

The results indicate that the present requirements for the pasteurization of milk (heating at from 142 to 145° F. for from 20 to 30 minutes) are adequate for destroying the most virulent

strains of *Br. abortus*. In no instance did the 40 guinea pigs inoculated with 1 cc of the artificially infected milk that had been heated for 20 to 30 minutes at 142 or 145° F. show evidence of infection with *Br. abortus*. They were in excellent condition and had gained weight. The cultures from the spleens were negative and no agglutinins for *Br. abortus* were demonstrable in the serum when dilutions as low as 1:15 were used.

THE DISTRIBUTION OF ACID-FAST BACTERIA IN SOILS. Carl A. Frey and William A. Hagan. Jour. Inf. Dis., ixl (1931), 6, p. 496.

The authors, using a technic devised by Söhngen, were able to demonstrate the presence of acid-fast bacteria in a hundred samples of soils collected from various points of the United States. A method is described, by the use of which many, if not all, of these organisms may be isolated in pure culture. The organisms isolated in pure culture presented a diversity of cultural features in many instances resembling those of well-known organisms. They were grouped into three rough groups on the basis of cultural features. By means of cutaneous tests on sensitized or immunized guinea pigs, it has been shown that the organisms of any one of these groups exhibit a closer relationship to each other than to organisms of the other groups.

A STUDY OF TUBERCULOUS INFECTION BY WAY OF THE FEMALE GENITAL TRACT. Edwin M. Jameson. Amer. Rev. Tuber., xxv (1932), 2, p. 213.

Small cotton pledgets containing a known amount of a suspension of R1 tubercle bacilli were inserted into the vaginas of eleven healthy virgin guinea pigs and allowed to remain for 4 to 8 days. Ten of the animals thus treated showed a positive intracutaneous tuberculin reaction at the end of 87 days. Tuberculous lesions were demonstrated in the lymph-nodes of 6 animals when autopsied at the end of 100 days and one of them showed tubercles in the genital organs. There was no difference in the number of "takes" secured in animals inoculated during oestrum and during the resting stage. Many of the animals showed changes in the endometrium and ovaries which may be attributed to the tuberculous infection. Ascending tuberculosis infection by way of the female genital tract was produced in 11 of 12 animals inoculated *per vaginam* although tuberculous lesions were found in only fifty per cent of these.

THE EFFECT OF MECHANICAL GRINDING ON TUBERCLE BACILLI. Henry Stuart Willis. Amer. Rev. Tuber., xxv (1932), 2, p. 224.

Mechanical grinding of dried tubercle bacilli leads to the gradual loss of bacteria and to the concomitant formation of amorphous-blue staining matter in stained smears of the pulverized powder. Tubercle bacilli that have been dried for several months are tuberculogenic and usually pathogenic for guinea pigs. Dried tubercle bacilli that have been ground in a ball-mill for two days usually contain forms that are tuberculogenic and pathogenic for guinea pigs. Those that have been ground for longer than two days are occasionally tuberculogenic but are not pathogenic for guinea pigs. It is a curious well-known fact that intact tubercle bacilli, living or dead, and the extracted wax from tubercle bacilli are acid-fast and tuberculogenic, but the wax from pulverized tubercle bacilli losses its acid-fastness and its capacity to arouse anatomical tubercles.

BUREAU TRANSFERS

Dr. Clark H. Hays (O. S. U. '08), from Lincoln, Nebr., to Pierre, S. Dak., in charge of tuberculosis eradication and hog cholera control.

Dr. J. O. Wilson (O. S. U. '08), from Pierre, S. Dak., to Denver, Colo., in charge of tuberculosis eradication and hog cholera control.

Dr. Rudolph Snyder (Chi. '03), from Denver, Colo., to Washington, D. C., to the Packers and Stockyards Administration.

Dr. S. O. Fladness (Chi. '12), from the Packers and Stockyards Administration to assistant chief of the Field Inspection Division.

Dr. J. T. Dallas (O. S. U. '06), from Cheyenne, Wyo., to Boise, Idaho, as inspector-in-charge.

Dr. W. A. Sullivan (McK. '07), from Boise, Idaho, to Cheyenne Wyo., as inspector-in-charge.

Dr. Webster G. Reed (Chi. '18), from Albert Lea, Minn., to Mason City, Iowa, on meat inspection.

Dr. Jesse B. Snyder (McK. '11), from Mason City, Iowa, to Kansas City, Kans., on meat inspection.

Dr. A. W. Groth (St. Jos. '20), from New York, N. Y., to Sioux Falls, S. Dak., on meat inspection.

Dr. C. J. Young (K. C. V. C. '04), from Sioux Falls, S. Dak., to Fort Worth, Texas, on meat inspection.

Dr. Clarke Hedley (Cin. '07), from Newark, N. J., to Allentown, Pa., on meat inspection.

Dr. J. J. Martin (U. S. C. V. S. '17), from Irvington, N. J., to Pittston, Pa., on meat inspection.

Dr. Joseph Hannon (McK. '10), from Albia, Iowa, to Honolulu, Hawaii, on meat inspection.

Dr. B. H. Yenner (K. C. V. C. '05), from Indianapolis, Ind., to Cedar Rapids, Iowa, on meat inspection.

Reserve Corps

Major Clell B. Perkins is assigned to duty at Fort Jay, N. Y., effective upon completion of his present tour of foreign service in the Hawaiian Department.

Major Daniel H. Mallan is relieved from further assignment and duty as student, Command and General Staff School, Fort Leavenworth, Kans., effective upon completion of his present course of instruction, and will then proceed to Carlisle Barracks, Pa., and report to the commanding general for duty.

The promotion of 1st Lieutenant Ernest E. Hodgson to the grade of captain, to rank from February 2, 1932, is announced.

Veterinary Reserve Corps

New Acceptances

Lee, Aubrey Mac.....1st Lt....1511 Garfield St., Laramie, Wyo.
Copple, Bernard Isaac....2nd Lt....1610 Main St., Boise, Idaho

Promotions

To

Porch, Jesse P.....Lt. Col...Aux-Res. R. F. D. No. 3, Vienna, Va.
Bowers, Joseph Mitchell..Capt.....202 Mueller Ave., Crafton, Pa.
Johansen, Einer Wm.....1st Lt....5 Arthur St., Somerville, Mass.

Doctor Schoening Now Chief

Dr. Harry W. Schoening was appointed Chief of the Pathological Division, U. S. Bureau of Animal Industry, on January 2, 1932. He had been acting chief since the death of Dr. John S. Buckley, in September, and prior to that time was assistant chief of the Division. Dr. Schoening is a native of Philadelphia and a graduate of the University of Pennsylvania, class of 1907. The same year he entered the service of the Bureau and was assigned to meat inspection at Chicago. For six years he was stationed successively at Pittsburgh, Philadelphia, Allentown and Reading, Pa., and Richmond, Va. His connection was the Pathological Division dates from 1912. This service was interrupted by a short period of military service during the late war. From May, 1925, to June, 1926, he was a member of the Foot-and-Mouth Disease Commission of the U. S. Department of Agriculture, which went to Europe to study this disease.

ELEVENTH INTERNATIONAL VETERINARY CONGRESS, LONDON, 1930.

Receipts and Payments Account for the Period from January 1st, 1925, to September 30th, 1931.

Receipts

	£	s.	d.
To Balance from 1914 Congress	0	18	7
" Subscriptions	2,479	6	9
" Sale of Reports	115	8	9
" Sale of Badges	39	18	10
" Transferred from Exhibition Account	50	5	4
" Amount contributed from British Congress (1914) Fund	3,205	18	5
	£5,891	16	8

Expenses

	£	s.	d.	£	s.	d.
By Delegates' Expenses				82	16	2
" Clerical Assistance	442	10	4			
" Honorarium and Expenses, General Secretary	420	0	0			
" Expenses, Honorary Secretary	103	8	8			
				965	19	0
" Printing and Stationery (including reports for General and Sectional Meetings)				1,768	3	5
" Printing Three Volumes of Proceedings	938	13	8			
" Packing, Postage, etc., of Proceedings	183	11	11			
				1,122	5	7
" Permanent Commission				83	3	2
" Interpreters and Translators				124	10	8
" Sundries	31	1	4			
" Petty Cash and Office Postages	229	17	11			
" Telephone	6	18	9			
				267	18	0
" Hire of Central Hall				406	4	5
" ENTERTAINMENTS:—						
Conversazione at Natural History Museum	305	16	6			
Reception, May Fair Hotel	133	2	3			
R. A. F. Band	49	7	0			
Congress Dinner	44	13	7			
Toast-Master	9	9	0			
Ladies' Excursions	334	9	0			
				876	17	4
" Official Photographers				21	0	0
" Reporters				34	15	0
" Badges				61	0	6
" Office Furniture				60	3	2
" Audit Fee				10	10	0
" Bank Charges				6	10	3
				£5,891	16	8

J. W. BRITTLEBANK,
Honorary Treasurer.

We have audited the above account and certify it to be correct.

Woodhouse and Wilkinson,
Chartered Accountants,
28, Queen Street, London, E.C.4.

October 2nd, 1931.

*Published in accordance with Rule 49, of International Veterinary Congress, which provides that when all the work of the Congress has been completed, at the latest witnin two years, the committee appointed for that purpose at the final meeting of the Congress shall examine the accounts and shall publish them in the veterinary journals of those countries from which the largest number of members have been drawn.

MARYLAND STATE VETERINARY MEDICAL ASSOCIATION

The annual meeting of the Maryland State Veterinary Medical Association was held at Medical Hall, Baltimore, January 8, 1932, with about seventy-five members in attendance. Dr. Hulbert Young's presidential address was up to his usual high standard. He briefly reviewed the activities of the Association, as well as those in the scientific field during the past year.

The theme of the address proper was on the importance of nursing. A picture was drawn of the facilities available along this line in the medical hospitals and even in the caring for the sick in private homes. The speaker believes that there is a definite field for properly trained individuals for the nursing of animals. The greatest need for it at present is in the small-animal hospitals. There are also numerous cases of larger animals where the assistance of a nurse would prove a most practical investment in saving the life of the animal.

The second item on the program was a paper entitled, "Collection and Preparation of Material for Laboratory Diagnosis." It was delivered by Dr. H. W. Schoening, Chief, Pathological Division, U. S. Bureau of Animal Industry. This subject is always important and was handled in such a manner that it was a distinct addition to the program. Doctor Schoening stated that the practitioner who contemplates using laboratory service should have a knowledge of the proper specimens or tissues to submit for the particular disease suspected.

Samples should be collected and forwarded so as to reach the laboratory in as fresh a state as possible. Samples taken from badly decomposed carcasses, or samples improperly packed or delayed in transit, frequently arrive at the laboratory in such a state of decomposition that they are of little value for diagnostic purposes. Samples should be properly prepared, labeled, and securely packed. The labelling of the sample should include

the name of the tissue, the species of animal from which it was obtained, the name and address of the owner and the name and address of the person forwarding the sample. A letter invariably should be forwarded to the laboratory before or at the same time the sample is shipped, in which a full history of the case is given so that tests for the disease or diseases suspected can be immediately undertaken.

The materials usually forwarded may be classed according to the laboratory procedure as follows: serological, hematological, bacteriological, histological, parasitological, chemical, and live animals forwarded for observation and autopsy. The methods for procuring and handling specimens for each of these classes of examinations were discussed in detail.

The third paper consisted of case reports, and was presented by Dr. I. M. Cashell, of Washington, D. C. Doctor Cashell described several cases of paralysis in dogs in which the infra-red rays were used with most satisfactory results. He also described his treatment for enteritis with vomiting in dogs. Here, as in the other cases, nursing is of great importance. A special raw-meat-extract diet was described. It was suggested also that the fluid content of the body could sometimes be kept up by the subcutaneous injection of physiological normal salt solution.

The last paper of the morning session was a case report by Dr. J. P. Turner, Washington, D. C. The author stated that during October and November, twenty-two gilts that had farrowed two to three weeks previously, developed a paralysis within a few hours. This was accompanied by a refusal of food and water. The mammary secretion stopped abruptly. The animals all died within ten days after the paralysis appeared. No treatment seemed to be effective. Most of the little pigs also died. Several of them showed necrobacillosis of the pharynx and intestinal tract.

Postmortem examinations in one or two cases suggested septicemia hemorrhagica. The others showed a marked, acute inflammation of the large intestine. The ventral surface of the abdomen was bluish in color. The teats showed several necrobacillosis sores. The laboratory findings were negative for everything from septicemia hemorrhagica to swine erysipelas.

The herd had been double-treated against hog cholera at weaning time. The feed consisted of garbage together with a grain mixture. The garbage, however, was rich, fresh and clean. It came from a large hospital for mental diseases. The grain feed

was stopped immediately after the onset of the disease. No more cases developed. The remainder of the feed was sent to a laboratory for feeding and other tests, with negative results. Other hogs on the farm, consisting of shoats, boars and fattening hogs, received the garbage only. None of them became sick.

During the business meeting, Dr. R. R. Dykstra, president of the American Veterinary Medical Association, extended greetings from that Association. He also outlined the work of the Association and made a plea for an increased membership. Other associations represented at the meeting and extending greetings were Maryland Stockmen's Association, Maryland Dairy Association, Maryland Guernsey Association, Maryland Jersey Association, Maryland Holstein Association, Maryland Ayrshire Association and Maryland Medical Association.

Reports were received from the Executive Committee, the Legislative Committee, the Publicity and Civic Committee, the Coördinating Committee and the Committee on Incorporation, Constitution and By-laws. The officers elected were Dr. W. E. Campbell, Bel Air, President; Dr. R. C. Reed, College Park, Vice-President; and Dr. E. M. Pickens, College Park, Secretary-Treasurer. It was voted to hold the summer meeting at Ocean City. An invitation will be extended the Delaware Association. A special luncheon was held at the Fairfield Western Maryland Dairy.

The first paper of the afternoon session was entitled, "The Relation of the Streptococcus to Milk-Borne Infections." by Dr. J. Howard Brown, Johns Hopkins University. The author kindly furnished an abstract, which is as follows:

All milk contains streptococci, which may be from various sources. *Streptococcus lacticus*, which is usually responsible for the souring of milk, is probably a contaminant from milking utensils and not from the udder of the cow. In milk drawn with the utmost cleanliness from normal udders there may be few or many streptococci which may be regarded as present in the lower milk-ducts of many normal cows' udders. Some cows harbor so many of these streptococci or other bacteria that they are commonly known as "high counters" although they may show no physical evidence of udder disease. Cows with streptococcus mastitis pass large numbers of streptococci in their milk. There is no doubt that these infections are transmissible from one animal to another. However, the streptococci found in cases of mastitis and those found in apparently normal udders may be bacteriologically indistinguishable one from the other. The conditions under which they may acquire virulence and the conditions which may render the cow susceptible to active infection are not fully understood.

There is little or no evidence that the streptococci which commonly cause bovine mastitis are pathogenic for human beings, and bovine udder streptococci may be distinguished bacteriologically from the hemolytic streptococci which are pathogenic for man. Scarlet fever and

septic sore throat are the two streptococcus diseases of man which are often milk-borne. In epidemics of these diseases it was formerly commonly assumed that the milk had become contaminated by milk-handlers, contaminated bottles, etc. It is doubtful, however, whether extensive and prolonged epidemics arise from such contamination. In most of the more recent and more thoroughly studied epidemics of septic sore throat it has been found that the udder of a cow has become infected with the streptococcus of human origin and that the streptococci given off in large numbers in the milk of this cow have been responsible for the epidemic. Experiments have shown that the udders of some cows may be infected by rubbing septic sore throat streptococci onto the uninjured teat opening. It seems likely that during milking a man who harbors these streptococci and whose hands may be contaminated may infect an udder. It has also been found that the milk of a cow so infected may contain large numbers of the streptococci for several days before there are any noticeable physical signs of mastitis although eventually there develops a mastitis of varying severity. More recently udders have been found infected with scarlet fever streptococci and so it appears that the origin of milk-borne epidemics of scarlet fever may be the same as those of septic sore throat.

Bacteriologically it is difficult to distinguish the streptococci of scarlet fever from those of septic sore throat but the methods in use for the detection of one of these streptococci serve equally well for the detection of the other in samples of milk drawn from suspected udders.

The facts serve to indicate that: (1) In milk-borne epidemics of septic sore throat and scarlet fever it is of no significance merely to find in the suspected milk supply a cow with streptococcus mastitis. The streptococci found must be studied and found to be of the human type causing these diseases. (2) Persons suffering with sore throat or other hemolytic streptococcus infections should not be employed as milkers or milk-handlers. Every such suspected case should be subjected to bacteriological examination. (3) The condemnation of all milk containing bovine mastitis streptococci can not be recommended and is impracticable but individual cows and milk deliveries showing leucocytes or mastitis streptococci in large numbers should be ferreted out and every effort should be made to eradicate bovine mastitis for economic reasons. (4) Too much faith should not be placed in commercial pasteurization of milk. Every dairy should be subject to adequate veterinary and medical supervision.

The second paper was a case report presented by Dr. W. E. Campbell. The patient was a grade cow. A diagnosis of emphysema of the lung was made. This condition spread to the other internal organs and finally to the skin. At postmortem the exterior of the body was literally covered with great swellings. An explanation from the owner was to the effect that the animal had been drenched with linseed oil for a mild indigestion and that the oil had reached the lungs. This is supposed to have caused a marked dyspnea with rupture of the alveoli and the resulting escape of air into the tissues of the body.

The third paper also was a case report and was delivered by Dr. C. M. Grubb, Rockville, Md. The patient was a gelding about twenty years old and weighing about 1500 pounds. During the first few hours of sickness, the symptoms were those of spasmodic colic. The animal grew worse rapidly. Upon entering the rectum for an exploratory examination, an intense straining

was started, which lasted until the hand was removed. At the extreme length of the arm the lumen of the intestine seemed to get much smaller and a hard mass about six inches in diameter could be felt. It was thought that this mass was an impaction in front of a twist in the floating colon. The animal was destroyed and a postmortem examination held. The twist was found in the floating colon about three feet from the rectum. The hard mass, however, was not an impaction but the twisted loop of the colon with a tumor wrapped around it. The growth, while not carefully dissected out, resembled a scirrhous cord.

The last paper on the program was entitled, "Local Anesthetics in Veterinary Surgery," and was delivered by Dr. R. R. Dykstra. As it will be published, it will not be reported here.

The Ladies' Auxiliary meeting was well attended and was voted a great success.

E. M. PICKENS, *Secretary.*

SOUTHEAST KANSAS VETERINARY MEDICAL SOCIETY

The Southeast Kansas Veterinary Medical Society held a very interesting meeting at the Portland Hotel, Iola, Kansas, December 7, 1931, with twenty-one members in attendance.

Following a dinner, the Monarch Portland Cement Company quartette entertained with musical and vocal selections. Major Limbocked, U. S. Army, gave a very interesting talk on "The Cavalry."

Dr. Henry G. Stephenson, of Independence, Kans., who conducts the largest small-animal hospital in southeast Kansas, demonstrated the use of epidural anesthesia and nembutal in small animals, which created considerable interest.

Nine new members joined the Society, bringing the membership list up to twenty-three.

L. F. BARTHELME, *Secretary.*

CONFERENCE OF VETERINARIANS AT UNIVERSITY OF PENNSYLVANIA

The annual conference of veterinarians at the University of Pennsylvania Veterinary School, Philadelphia, was held January 6-7, 1932. Dr. Alfred Stengel, vice-president in charge of medical affairs at the University, opened the conference with a hearty address of welcome. The conference was very successful and

well attended, more than two hundred veterinarians from Pennsylvania, New Jersey, Delaware, Maryland, and neighboring states being present.

Infectious diarrhea (winter scours) in cattle, which is an important disease in Pennsylvania, New Jersey, and other states, was discussed by Dr. F. S. Jones, of the Rockefeller Institute. Dr. Jones has come to the conclusion that the causative agent is a vibrio, which he has named *Vibrio jejunum*, because the principal lesions are found in the jejunum.

"The Uses Made of the X-Ray in Diagnosis" was presented by Dr. M. A. Emmerson, who showed some pictures he had taken at the University of Pennsylvania Veterinary Hospital. He discussed the most important of these, emphasizing the value of the x-ray in arriving at a correct diagnosis.

Dr. M. J. Harkins, of Conshohocken, Pennsylvania, gave a demonstration of handling and restraining rabbits for examination, castration and treatment. He advised practitioners to have the owners do most of the handling, as valuable rabbits are easily injured.

Dr. R. B. Little, of the Rockefeller Institute, reported on some cases of demodectic mange in cattle, the symptoms of which differ from those of the same disease in dogs. It is possible that many cases of puzzling skin lesions in cattle are due to *Demodex folliculorum.*

Dr. C. P. Bishop, of the Pennsylvania Bureau of Animal Industry, Harrisburg, presented a very instructive paper on tuberculosis, with special reference to new legislation.

Dr. M. F. Barnes, director of the Bureau of Animal Industry Laboratory, gave the results of some experimental work with rabies carried on at the laboratory at Harrisburg.

Dr. C. D. Marsh, formerly physiologist in charge of the investigation of stock poisoning by plants, U. S. Department of Agriculture, gave a very interesting illustration lecture entitled, "Som Important Stock Poisoning Plants."

Dr. H. C. Campbell, of the University of Pennsylvania, in discussing "The Effect of Storage on the Fat Test of Composite Samples of Milk" stated that the Babcock test was not a simple test. Dr. Campbell considers a fat test on a composite sample of milk to be as accurate as a test made at the farm, but that these tests cannot be expected to agree.

Dr. J. E. Shillinger, of the U. S. Biological Survey, reviewed the work being done by the federal government in the field of

disease control in wild animals. He presented a moving-picture film showing cases of encephalitis in foxes, as well as pictures of the fur industry.

Dr. J. V. LaCroix, of Evanston, Illinois, told how canine distemper is handled at the North Shore Veterinary Hospital. He stressed the importance of diet, especially in cases of diarrhea.

Dr. R. R. Dykstra, president of the American Veterinary Medical Association, gave a very interesting illustrated lecture on the surgical methods of draining sinuses in the bovine and equine. He also discussed local anesthesia by nerve-blocking.

Dr. H. C. Crawford, of Bellerose, New York, presented a splendid paper on lameness in horses. He treated the subject from a new angle and emphasized lameness due to neuroses. Following his paper, Dr. Crawford gave a brief description of the veterinary schools of Europe.

J. D. BECK, *Reporter.*

INTERMOUNTAIN LIVESTOCK SANITARY ASSOCIATION

The annual meeting of the Intermountain Livestock Sanitary Association was held at Ogden, Utah, January 11-13, 1932. Although this organization is still in its infancy, the attendance and the character of the program have each year reached a higher plane, indicating that veterinarians residing among the great open spaces of this intermountain territory are making every effort to coöperate in controlling disease and parasitic problems. The three-day meeting was attended by veterinarians from seven surrounding states.

Dr. I. E. Newsom, of Fort Collins, Colo., a vice-president of the American Veterinary Medical Association, was in attendance to represent the national organization.

Officers elected for the following year are: President, Dr. H. D. Port, Cheyenne, Wyoming; vice-presidents, Dr. E. M. Gildow, Moscow, Idaho and Dr. W. D. Earl, Reno, Nevada; secretary-treasurer, Dr. D. E. Madsen, Logan, Utah.

D. E. MADSEN, *Secretary.*

VETERINARY MEDICAL ASSOCIATION OF NEW JERSEY

The forty-eighth annual meeting of the Veterinary Medical Association of New Jersey was held at the Hotel Plaza, Jersey City, January 13-14, 1932. The attendance was the largest for

several years, more than one hundred twenty-five being registered.

Those contributing to the program included Dr. C. P. Zepp, of New York City, on "Fractures in Small Animals"; Dr. R. J. Garbutt, New York City, on "Hospitalization"; Dr. F. S. Jones, Rockefeller Institute, Princeton, "A Discussion of Certain Acute Infectious Intestinal Disorders of Cattle"; Dr. J. F. DeVine, Goshen, New York, "Some Phases of Bovine Practice"; Dr. W. J. Lentz, University of Pennsylvania School of Veterinary Medicine, Philadelphia, "Feline Diseases"; and Dr. H. M. O'Rear Bureau of Animal Industry, Washington, "The Application of the Intradermic Tuberculin Test." All these papers were ably presented and interesting. Several were illustrated and Dr. O'Rear also presented a demonstration of intradermic tuberculin test technic which attracted a great deal of favorable attention.

Dr. R. R. Dykstra, president of the American Veterinary Medical Association, also attended the meeting and made two valuable contributions to the program; one was an illustrated talk on "The Use of Local Anaesthetics"; the second was a talk on the American Veterinary Medical Association and the veterinary profession, at the association dinner.

The Association took action to approve affiliation with the American Veterinary Medical Association, and also adopted a resolution presented by Dr. Thomas E. Smith, calling the attention of the Department of Health to the serious increase in rabies in the State.

All officers of the Association were re-elected for another year: President, R. W. Butterworth, Paterson; first vice-president, W. B. Maxson, Flemington; second vice-president, E. R. Cushing, Plainfield; treasurer, Harry Ticehurst, Shrewsbury.

The semi-annual meeting will be held in Atlantic City in July.

J. G. HARDENBERGH, *Secretary.*

STATE VETERINARY MEDICAL ASSOCIATION OF TEXAS

The ninth semi-annual meeting of the State Veterinary Medical Association of Texas was held January 15-16, 1932, at the Jefferson Hotel, at Dallas. The meeting was well attended both days, some sixty or seventy being present, many accompanied by their wives.

The meeting was formally opened by Dr. Frank Hecker, of Houston, president of the Association. The address of welcome was by Mr. J. B. Critz, manager of the Dallas Chamber of Commerce, and the response by Dr. H. L. Darby, inspector-in-charge, U. S. B. A. I., Fort Worth.

The program was largely composed of Texas men, who very efficiently handled subjects suggested by a questionnaire sent out to all members, proving that Texas has some very able talent in the profession. The subjects assigned were as follows:

"Prevention and Treatment of Stomach and Intestinal Parasites of the Horse," by Dr. R. P. Marsteller, Vice-Dean, School of Veterinary Medicine, Texas A. & M. College.

"Fowl Paralysis," by Dr. R. C. Dunn, Texas A. & M. College.

"The Veterinarian and the Milk Supply," by Dr. M. E. Starnes, Chief Meat and Dairy Division, City Health Department, Dallas.

"Municipal Meat Inspection," by Dr. J. S. Grove, General Manager, Municipal Abbatoir, Austin.

"Anaplasmosis," by Dr. H. Schmidt, Texas Agricultural Experiment Station, College Station.

"Bang's Infectious Abortion and Mastitis," by Dr. T. O. Booth, Temple.

"Equine and Bovine Choke," by Dr. Jas. S. Watson, Mexia.

"Tuberculosis-Free Accredited Areas and Testing of Range Herds," by Dr. N. F. Williams, Chief Veterinarian, Live Stock Sanitary Commission of Texas, Fort Worth.

"Canine Distemper," by Dr. A. A. Lenert, Texas A. & M. College.

"Brown Dog Ticks (*Rhipicephalus Sanguineus*)," by Dr. U. S. Marney, San Antonio.

"Diseases of the Eye in Small-Animal Practice," by Dr. H. V. Cardona, Fort Worth.

The Association was also fortunate in securing Dr. H. Wood Ayers, president of the Oklahoma Veterinary Medical Association, and Dr. I. B. Boughton, late of the Department of Agriculture, Republic of Haiti, now a member of the veterinary staff at the Agricultural Experiment Station, College Station.

Dr. Ayers' subject, "The Rabbit and Cavy Industry," was a high light on the program and was much enjoyed. Dr. Ayers demonstrated very thoroughly that the packing products and fur make a successful venture. Dr. Boughton's subject, "Problems of the Tropics," proved something new and very interesting to his hearers.

A banquet was served on the roof garden to seventy-seven members and guests. Dr. Frank Hecker, president of the Association, acting as toastmaster. A program and dance followed.

The Ladies' Auxiliary held its regular mid-winter meeting jointly with the Association. About twenty-five ladies attended, much delightful entertainment being provided.

D. PEARCE, *Secretary.*

OKLAHOMA VETERINARY MEDICAL ASSOCIATION

The seventeenth annual meeting of the Oklahoma Veterinary Medical Association was held in the Skirvin Hotel, Oklahoma City, January 18-19, 1932, with an attendance which not only fulfilled all expectations, but exceeded them by a substantial number. The register showed a total attendance of seventy-six, among whom were a number of well-known, out-of-state visitors.

The two-day program, on which dairying and related subjects occupied a prominent place, proved to be an unusually interesting one. Dr. F. C. Pryor, of Wewoka, read the opening paper under the title of "Random Shots," which contained an interesting summary of his personal observations and experiences in the use of some of the newer pharmaceutical preparations, particularly in small-animal practice, and a fund of sound advice on the management of a small-animal hospital.

"Building and Management of a Dairy Herd," an interesting and timely animal husbandry subject, was ably presented by Prof. P. C. McGilliard, of the Dairy Division, Oklahoma A. & M. College.

Dr. E. E. Harnden and Prof. E. L. Fauts, both of the Oklahoma A. & M. College, spoke on the laboratory end of milk inspection. Their lectures and demonstrations of the various laboratory tests used in connection with milk inspection were followed with interested attention to the end.

Dr. A. T. Kinsley, of Kansas City, Missouri, covered the subject of "Milk-Borne Diseases" in his usual inimitable way. His remarks showed clearly that while every veterinarian cannot be an authority on this subject, he should at least so inform himself as to be thoroughly conversant with it.

Dr. E. L. Dicke, of Louisburg, Kansas, gave a comprehensive and unusually interesting talk on "The Physical Examination of the Cow in Routine Dairy Inspection with Special Observations on Mastitis." Dr. Dicke has had a wide experience in this field, and his paper contained a great deal of both new and old information of value on this important subject.

Dr. H. Schmidt, of College Station, Texas, gave an exceptionally instructive discussion of "Mineral Requirements in Relation to Certain Diseases of Cattle." The interest which was manifest by numerous questions indicates a growing demand for more complete information regarding the proper balance of minerals and their relation to animal nutrition.

Under the caption of "City Meat Inspection," Dr. J. S. Koen, Chief Meat Inspector, Department of Public Welfare, Saint Louis, Missouri, gave a complete account of the inception, organization and operation of the municipal meat inspection project in the city of Saint Louis, recently inaugurated. Saint Louis deserves much credit for having added this important branch to its public health department. It is to be hoped that many other cities will follow its example.

The remainder of the program was devoted to the following subjects: A round-table discussion, led by Dr. Kinsley, brought out many problems in connection with abortion disease; an excellent paper on "Canine Distemper," by Dr. Chas. Salsbery, of Kansas City, Missouri; "Problems in Connection with Swine Practice, with Special Reference to Swine Erysipelas," by Dr. C. C. Nickel, of Nowata; a review of the recent anthrax outbreak in Oklahoma, by Dr. J. H. Wirtz, Deputy State Veterinarian, Oklahoma City; and a résumé of the work done by the A. V. M. A. towards bringing about a better understanding between the veterinary profession and the various branches of agricultural extension forces, by Dr. J. S. Koen.

The annual banquet, served on the evening of the first day, easily ranks among the best ever held by this Association. Excellent food, entertaining speakers, and good music, both vocal and instrumental, made it an enjoyable affair to nearly one hundred members, ladies and friends, who attended. Dr. E. T. Martin, of Tulsa, occupied the toastmaster's chair. The banquet was followed by dancing, in which young and old took part.

Visiting ladies, to the number of twenty-two, were guests of the Association. Entertainment provided for them consisted of a line party at Oklahoma City's most beautiful theater, and a noon-day luncheon on the roof garden of the Skirvin Hotel.

The new officers of the Association are: Dr. C. C. Nickel, Nowata, president; Dr. W. C. McConnell, Holdenville, vice-president; Dr. C. H. Fauks, Oklahoma City, secretary; Dr. F. Y. S. Moore, McAlester, treasurer.

C. H. Fauks, *Secretary.*

NEVADA STATE VETERINARY ASSOCIATION

The annual meeting of the Nevada State Veterinary Association was held January 20, 1932. The morning and afternoon sessions were held in the Agricultural Building, on the University of Nevada campus. The evening session was held at the Hotel

El Cortez, following a banquet for the members and their guests.

The following program was presented:

"Methods Used in the Investigation of Poisonous Plants," by Mr. M. R. Miller, Reno.

"Poisonous Range Plants," by Dr. L. R. Vawter, Reno.

"Sheep Disease Investigations," by Dr. J. A. Howarth, Davis, Calif.

"Tuberculosis in Turkeys," by Dr. W. R. Hinshaw, Davis, Calif.

"Turkey Production and Disease Control Methods in Nevada," by Dr. K. W. Niemann, Reno.

"Immunization of Turkeys Against Fowl-Pox," by Dr. W. R. Hinshaw, Davis, Calif.

"Experiences in the Production and Maintenance of Healthy Race Horses, by G. E. Bamberger, Reno.

"Epizoology of Encephalomyelitis on the Newlands Irrigation Project," by Dr. K. W. Niemann, Reno, and G. T. Woodward, Fallon.

"Investigations Relative to the Etiology, Pathogenesis and Pathology of Encephalomyelitis," by Dr. L. R. Vawter, Reno.

"Treatment and Control of Encephalomyelitis in California," by Dr. J. A. Howarth, Davis, Calif.

The symposium on encephalomyelitis was featured by motion pictures of the disease as it has been found in California. A general discussion of encephalomyelitis and poliomyelitis followed, Dr. Edward Records leading the discussion.

At the business session, a sum of money, based on the number of active members of the Association, was pledged to be placed at the disposal of the Committee on International Veterinary Congress.

Officers were elected for the ensuing year as follows: President, Dr. F. E. Henderson, Elko; vice-president, Dr. W. F. Fisher, Elko; secretary-treasurer, Dr. Warren B. Earl, Reno.

WARREN B. EARL, *Secretary.*

SOUTH DAKOTA VETERINARY MEDICAL ASSOCIATION

The thirteenth annual meeting of the South Dakota Veterinary Medical Association was held at the Cataract Hotel, Sioux Falls, January 21-22, 1932. The total attendance reached 114. Dr. L. E. Eggleston, of Alcester, presided over the several sessions.

The address of welcome was given by Mr. Fred Larkin, of the Sioux Falls Chamber of Commerce. This was followed by the presidential address of Dr. Eggleston, and his remarks went a long way toward bringing out the good feeling and fellowship that existed throughout the meeting.

The first paper was by Dr. R. S. Robinson, Director of the Department of Animal Industry, on disease conditions in South Dakota during the year. This was a very complete report and included the work done by the Department.

Dr. H. J. Classick, of Hurley, presented a very interesting case report, the discussion of which was led by Dr. L. A. Merillat, of Chicago.

A paper on undulant fever in humans was presented by Dr. W. C. Forsberg, a physician, of Sioux Falls. Dr. Forsberg has done quite a little resesarch work on this disease, and the members considered it a great privilege to have him present his paper at the meeting. The subject had been presented to meetings of several medical societies, in South Dakota and other states, but Dr. Forsberg had rewirtten it in order to bring out a good discussion from the standpoint of the veterinarian and the possible sources of infection from cows affected with Bang's disease.

Dr. Ashe Lockhart, of Kansas City, Mo., gave a very interesting talk on the use of blood in veterinary practice in general and in small-animal practice in particular. He cited some very interesting results that had been obtained from blood transfusions on some of the large breeding farms near Kansas City and in different parts of Kentucky. Dr. Lockhart also touched on the different methods which he has been using for the administration of tetanus antitoxin.

At 6:30 about 100 veterinarians gathered in the banquet-room of the Hotel, and a very delightful dinner was served, during which entertainment was furnished by a group of professionals. President Eggleston acted as toastmaster and called on a number of the prominent veterinarians present, for short talks.

There were about thirty-five ladies present at the meeting and the banquet, and they were kept real busy, during the entire time, with theatre parties and luncheons as guests of the commercial houses and the Sioux Falls Chamber of Commerce.

The first session of the second day was opened with a paper by Dr. A. M. Anderson, of Luverne, Minn., on forage poisoning. This was of considerable interest to all present, as there had been considerable of this disease throughout parts of the Northwest during the past fall. A splendid discussion followed the presentation of the paper.

The balance of the forenoon was taken up with a discussion of swine erysipelas, following a paper on that subject by Dr. T. W. Munce, of Sioux City, Iowa. Dr. A. A. Fosterman, of Utica, presented a short paper on the results of the use of swine erysipelas serum in his hands. He exhibited the heart of a pig affected with the disease, showing pronounced cauliflower lesions. Dr. Fosterman also showed a number of photographs of infected

herds. The veterinarians present who had not had an opportunity to come in contact with this disease showed a keen interest in the subject and a desire to secure whatever knowledge they could as to proper diagnostic methods and the possible prevention or treatment of the disease.

The election of officers for the ensuing year resulted as follows: President, Dr. N. J. Mayer, Mitchell; vice-president, Dr. Carl B. Lenker, Colome; secretary-treasurer, Dr. Geo. E. Melody, Hoven.

At the afternoon session, Dr. H. B. Treman, of Rockwell City, Iowa, presented a paper covering a number of practical problems in which the practitioners were interested. His paper was very complete in every detail and contained a wealth of information on such subjects as equine foot operations, swine obstetrics, cesarean section in the sow, dentistry, teat operation in the cow, and so forth. Dr. Treman was extended a rising vote of thanks for his most excellent paper and practical demonstrations.

Mr. F. E. Briggs, state inspector for the South Dakota Pharmaceutical Association, gave a detailed report of the work being done in the State, in connection with enforcing the laws governing the sale of misbranded products and drugs by house-to-house peddlers. It is believed that this work will indirectly be of value to the veterinarian

The question of affiliating the Association with the American Veterinary Medical Association was brought up and details of the plan were explained by Dr. Clark H. Hays, member of the Executive Board of the A. V. M. A. It was voted to have the President appoint a committee to work out the details.

G. E. MELODY, *Secretary-Treasurer.*

HUDSON VALLEY VETERINARY MEDICAL SOCIETY

The regular quarterly meeting of the Hudson Valley Veterinary Medical Society was held in Albany, February, 10 1932. The Society had as guests, from the State Department of Health, Dr. Paul B. Brooks, Deputy Commissioner; Dr. H. S. Senftner, Director, Bureau of Communicable Diseases, and Mr. W. D. Tiedeman, Chief, Bureau of Milk Sanitation.

The President, Major L. L. Shook, of West Point, called the meeting to order after luncheon at the DeWitt Clinton Hotel, and introduced Dr. R. R. Birch, of the N. Y. State Veterinary College, who discussed "Getting Started with the Blood Test." Dr. Birch gave a very complete outline of the present knowledge with

respect to the use of the agglutination test in detecting Bang's disease, and answered numerous questions relative thereto.

The representatives of the Department of Health gave brief addresses with particular reference to the relationship of this disease to the human family. The importance of milk control was stressed and the opinion expressed that pasteurization offered the surest means of protection to the consumer of milk.

At the business session the Society went on record as favoring regulations governing the interstate movement of cattle to prevent Bang's disease being introduced into the State. At the invitation of President Shook, the Society voted to hold the next meeting at the U. S. Military Academy, West Point, on May 11, 1932.

This meeting was one of the largest and most interesting that the Society has held in some years.

J. G. WILLS, *Secretary-Treasurer.*

ALABAMA SHORT COURSE FOR GRADUATE VETERINARIANS

The annual Short Course for Graduate Veterinarians was held at the Alabama Polytechnic Institute, Auburn, February 1-6, 1932.

Dr. W. L. Williams, of Cornell University, was the leading speaker and instructor. He gave a series of lectures on the breeding problems of cattle and horses. He discussed the prevention of the diseases of breeding cattle, in all their phases. One thing he considers of great importance in the prevention of breeding diseases of cattle is not to breed heifers when they are immature or too young. Many dairy and beef cattle breeders stunt their breeding dams by early breeding and thus reduce their resistance to such diseases as abortion. Dr. Williams also brought out the fact that many herd bulls are used when too young, thus reducing their potency as sires and also lowering the resistance to disease in their offspring. Dr. Williams illustrated his lectures with numerous fresh specimens, as well as with lantern-slides.

Dr. D. M. Campbell, of Chicago, made his second annual visit to Auburn and the Short Course. He had attended some four or five other conferences and short courses and he was able to bring to the Alabama veterinarians many of the new things that had been presented at other places. Dr. Campbell also

discussed Army veterinary problems as he had observed them at Army schools of instruction. The veterinarians present were pleased with his talks on feeds and feeding of dogs.

Col. B. A. Seeley, V. C., U. S. Army, located at Fort Benning, Ga., described his method for handling foot diseases in Army horses. He also touched briefly on pathological shoeing of Army horses and mules.

Dr. Mack Hays, of Auburn, described in full his procedure for immunizing dogs against distemper. One thing that he stressed was not to start the immunization process in a dog that is already sick. As an illustration he exhibited a dog that had been suffering from coccidiosis when he started to immunize it against distemper. The result was unfavorable. Dr. Hays also gave his methods of treating parasitic skin diseases, as well as a clinical demonstration in the diagnosis and treatment of quite a number of canine diseases.

Dr. M. W. Emmel, of Auburn, demonstrated his method of holding a postmortem on the chicken. He also described his method of vaccinating chickens against chicken-pox, using pigeon-pox virus. The best time to do this is when the birds are three to four months old and Dr. Emmel advised against doing it when the birds are affected with any other disease or are in poor condition for any cause whatever.

Dr. C. A. Cary, assisted by a number of veterinarians engaged in tuberculosis eradication work, gave a demonstration of the intradermal injection of tuberculin in the caudal fold and in the labiae of the vulva in cattle. He stressed the importance of not injecting too much tuberculin. This might produce a reaction and the animal would fail to show any lesions at autopsy. He also stressed the importance of injecting enough tuberculin, pointing out that an insufficient dose might fail to produce a reaction in a tuberculous animal. He also warned against injecting the tuberculin subcutaneously when trying to inject it intradermally. This would result in failure to secure a reaction in a tuberculous animal.

At the clinic there were two cases in mules of what Frohner called dry gonitis. The diagnosis was made by a number of the attending veterinarians and one case was treated by applying a strong blister. The other case was treated by the method used by Dr. E. B. Ackerman. Dr. Campbell injected deeply into the tissues around the articulation, one-half to one cubic centimeter of Lugol's solution, in six places, one in front and the others on

the medial and lateral surfaces. Observations were made of each case every day and the results were favorable in both animals, although the time was too short to draw definite conclusions. Dr. Campbell holds that the injections of Lugol's solution, as a means of setting up counter-irritation, are superior to blistering in those regions where the affected structures are overlaid by muscle tissue.

At one of the evening sessions, Dr. Williams delivered his steriopticon lecture on Hawaii, which was most interesting and instructive. The banquet of the Veterinary Medical Society was a social as well as a howling success, without any stimulants stronger than water, coffee and fried chicken.

At a business session of the Alabama Veterinary Medical Association, held on February 5, several new members were admitted to the Association and an appropriation of $150.00 was made for the Committee on Local Arrangements at Atlanta, in connection with the sixty-ninth annual convention of the American Veterinary Medical Association, to be held in that city in August. The Association voted to omit its summer meeting in deference to the A. V. M. A. convention in Atlanta.

C. A. CARY, *Secretary.*

MANITOBA VETERINARY ASSOCIATION

The annual meeting of the Manitoba Veterinary Association was held at the Royal Alexandra Hotel, Winnipeg, February 3, 1932, with about forty members in attendance.

Owing to the recent death of the President, Dr. J. B. Still, and the unavoidable absence of the Vice-President, Dr. J. F. Skinner, the chair was occupied by Dr. Owen McGuirk, of Dauphin, who called on the members to stand in silence for one minute, as a token of respect to the memory of the late president. Dr. W. A. Shoults then paid tribute, in a few well chosen words, to the late Dr. Still and the part he had played in the advancement of the veterinary profession in the Province.

The report of the Secretary-Treasurer showed a total registration of 103 active members and eleven honorary members. The financial statement showed a balance on hand of $283.00.

Drs. E. Green, of Birtle, and J. Hodgins, of Newdale, were appointed honorary members.

A motion was passed to donate the sum of $25.00 towards the expenses of the International Veterinary Congress, to be held in Philadelphia, in 1934.

Officers for the coming year were elected as follows: President, Dr. J. F. Skinner, Morris; vice-president, Dr. F. C. Bishop, Dauphin; secretary-treasurer and registrar, Dr. William Hilton, Winnipeg. These officers, with Drs. R. H. Lay, Owen McGuirk, J. R. Fisher and H. R. McEwen, constitute the Council.

During the afternoon session the meeting was addressed by Mr. J. H. Evans, Deputy Minister of Agriculture for the Province, and the following papers were presented: "Necrotic Enteritis of Swine," Dr. J. R. Fisher, Brandon; "Anthrax," Dr. M. T. Lewis, Provincial Department of Agriculture; "Bovine Coccidiosis," Dr. A. Savage, Manitoba Agricultural College; a case report by Dr. H. R. McEwen, Stonewall, and a report on the 1931 clinic, by Dr. W. A. Harron, Buelah.

WILLIAM HILTON, *Secretary-Treasurer.*

DENVER ALLIED VETERINARIANS

On February 26, 1932, thirteen practitioners of Denver, Colorado, and its suburbs met at the hospital of Dr. Jay H. Bouton and organized the Denver Allied Veterinarians. Dr. G. C. Miller was elected president, Dr. Jay H. Bouton, secretary, and Dr. M. J. Woodliffe, treasurer.

The question of uniform fees was taken up and satisfactorily settled. A discussion of canine otitis of various types followed, and a technic for its surgical relief was described.

Meetings will be held on the third Friday in each month, at the hospitals of the members, in alphabetical sequence.

JAY H. BOUTON, *Secretary.*

TWIN CITY VETERINARY MEDICAL ASSOCIATION

The Twin City Veterinary Medical Association met at University Farm, Saint Paul, Minn., the evening of February 26, 1932. About 35 members were in attendance.

The address of the evening was delivered by Dr. R. N. Bieter, Associate Professor of Pharmacology, University of Minnesota Medical School. His topic was "The Physiology of the Kidney." For the past several years Dr. Bieter has been making an intensive study of the kidney, including the kidney functions of fish, birds and mammals. It was interesting to learn that certain fish, notably the toad-fish and goose-fish, have an aglomerular kidney and only a small portion of the tubules, known as the loop of Henle. These fish are strictly salt-water varieties and have a

urine output of from 2 to 4 cc per kilogram of body weight each 24 hours. This amount may be contrasted with the excretions of some of the fresh water fish having glomeruli, whose urine output is about 100 to 150 cc per kilogram of body weight each 24 hours. In the case of man and some of our domestic animals, the output would be about 20 cc per kilogram per day.

It was stated by Dr. Bieter that from 500 to 600 liters of blood pass through the glomeruli of the kidneys in 24 hours, and the blood pressure in the glomeruli is even greater than in some of the larger arteries. A filtration process occurs in the glomeruli, but when the fluids reach the loop of Henle an absorption of the water takes place and with it many of the soluble substances that were filtered out in the glomeruli. This process of reabsorption by the kidney is one of the newer ideas on kidney function. It has been estimated that there are approximately 400,000 glomeruli in both kidneys of the cat: 2,300,000 in the pig; 800,000 in the dog; 8,000,000 in cattle, and from 2 to 5 million in man. It is known that all of these glomeruli do not function at any one time under normal conditions, and that there is a great excess in the number of functional units in the kidney. In fact, it was stated, animals with only one-fourth of the normal kidney substance left can live comfortably if not required to do excessive work or exercise.

H. C. H. KERNKAMP, *Secretary.*

SAGINAW VALLEY VETERINARY MEDICAL ASSOCIATION

A meeting of the Saginaw Valley Veterinary Medical Association was held at the Court House, Flint, Michigan, March 3, 1932, with an attendance of thirty members. The following program was presented:

"Cases of Interest," Dr. J. S. Donald, Bay City.
"Gastro-Enteritis in the Dog," Dr. H. L. Cole, Saginaw.
"City Inspection," Dr. R. E. Hammond, Flint.
"Roaring Operation," Dr. J. Fries, Durand.
"Bang's Disease Problems," Dr. B. J. Killham, East Lansing.

H. L. COLE, *Secretary.*

Anniversary of Koch's Discovery

March 24, 1932, marked the fiftieth anniversary of the discovery of the tubercle bacillus by Dr. Robert Koch. The event was the occasion for appropriate tributes to the great scientist by many medical and allied organizations throughout the world.

NECROLOGY

WALTER J. TAYLOR

The body of Dr. Walter J. Taylor, of Clymer, N. Y., was found in the bed of a creek, about two miles from Clymer, on December 1, 1931. He had been missing from his home about 24 hours and it is believed that death resulted from a fall, when his head struck an abutment of the bridge over the creek. He was on a professional call at the time.

Dr. Taylor was a graduate of the New York State Veterinary College at Cornell University, class of 1906. He remained at the institution until 1910, when he accepted a position at the Montana Agricultural College, at Bozeman. He remained there about three years, then going to the University of California, at Berkeley. Several years later Dr. Taylor accepted a position with the Canal Zone Commission and spent about six years in the tropics. He resigned in June, 1922.

Dr. Taylor joined the A. V. M. A. in 1906. He was 50 years old at the time of his death.

JOSEPH A. BEAVERS

Dr. J. A. Beavers, of Canton, Mississippi, died December 24, 1931.

Born in Scott County, Mississippi, Dr. Beavers studied veterinary medicine at the Kansas City Veterinary College and was graduated in 1911. For many years he lived and practiced in Canton and was a popular citizen of that place. For some years he was a member of the Mississippi State Live Stock Sanitary Board and held many high and responsible positions in connection with the live stock industry of the State.

Dr. Beavers joined the A. V. M. A. in 1915. He was also a member of the Mississippi State Veterinary Medical Association. A resolution adopted by the latter organization paid Dr. Beavers the following tribute:

In his death Canton loses a useful citizen and this Association an honored and loved member. As a veterinarian he was an able practitioner. It is the friendship of such a man as Dr. Beavers that makes life happy. His noble qualities have been a stimulant to us who had the happiness and pleasure to share his confidences. We loved him in life, and we respect his memory now that he is dead. His striking figure will still seem to be hovering about our veterinary meetings for many years. Dr. Beavers was unpretentious and most winning in his manner. More than ready and willing at any and all times to render assistance in such matters as he thought might elevate the standing of the veterinary profession.

CARLTON RAY OSBORN

Dr. Carlton R. Osborn, of Abilene, Kansas, died at his home, January 3, 1932. Although he had been in poor health for some time, his death was unexpected.

Born at Wanatah, Indiana, January 11, 1870, Dr. Osborn attended local schools and then entered the McKillip Veterinary College. Following his graduation in 1908, he located for general practice at Brook, Indiana, where he remained for about nine years. He then entered the service of the U. S. Bureau of Animal Industry and was located at Chickasha, Okla., for about two years. He was then transferred to Abilene, Kansas, where he remained until his death.

Dr. Osborn joined the A. V. M. A. in 1918. He was a member of the National Association of B. A. I. Veterinarians. He is survived by his widow (née Alice M. Lee), two daughters and three brothers.

ADOLF RUTH

The remains of Dr. Adolf Ruth were found on January 8, 1932, in the Superstition Mountain range. He is believed to have lost his life while prospecting. Dr. Ruth was a graduate of the Kansas City Veterinary College, class of 1903, and spent practically all of his professional career in the employ of the U. S. Bureau of Animal Industry. He was placed on the retired list several years ago.

LE ROY B. FOX

The death of Dr. Le Roy B. Fox, of Missoula Montana, has been reported. He was a graduate of the Kansas City Veterinary College, class of 1912, and joined the A. V. M. A. in 1916, while located at Bartlesville, Okla.

CHARLES BAYNES

Dr. Charles Baynes, of Tacoma, Washington, died January 30, 1932. He was a graduate of the Chicago Veterinary College, class of 1902, and first joined the A. V. M. A. in 1907. He had been a resident of Tacoma during this entire time.

THOMAS WRIGGLESWORTH

Dr. Thomas Wrigglesworth, of Eau Claire, Wisconsin, died at his home, February 24, 1932. Although he had been ill for four years, his condition became serious only a short time prior to his death.

Born at Ashgrove, Ontario, January 20, 1857, Dr. Wrigglesworth studied veterinary medicine at the Ontario Veterinary College. Following his graduation, in 1882, he located at Duluth, Minn., where he remained for about two years, then going to Eau Claire, which was his residence for the balance of his life.

On the occasion of his 75th birthday, January 20, 1932, Dr. Wrigglesworth was presented with an honorary life membership in the Wisconsin State Veterinary Medical Association, in recognition of his faithful service to the organization and the profession. He was a past president of the Association.

Dr. Wrigglesworth was a member of the Masonic order as well as of the Modern Woodmen of America. He is survived by his widow, three sons, one daughter, two sisters and one brother.

JAMES POWELL DRAPER

Dr. James P. Draper, of Lowell, Mich., passed away very suddenly, at his home, February 24, 1932. He had been suffering from a light attack of influenza and had taken some medicine containing strychnin. He died in convulsions thirty minutes later, in spite of heroic efforts upon the part of his physician.

Born at Stratford, Oxford, July 31, 1865, Dr. Draper attended school in Toronto before coming to Michigan. He was graduated from the Grand Rapids Veterinary College in 1906. He immediately located in Lowell, where he practiced until his death. He was a lover of horses and took a keen interest in local racing events.

Dr. Draper joined the A. V. M. A. in 1912. He was a member of the Michigan State Veterinary Medical Association. His fraternal affiliations included the Masons and the Independent

Order of Foresters. He is survived by his widow (née Frances Wilkie), one brother and two sisters.

J. N. GOULD

Dr. J. N. Gould, of Worthington, Minn., died at his home, February 26, 1932. He had been suffering from asthma and sinusitis for the past three years. Several months before his death he underwent a radical sinus operation and made a splendid recovery. However, following his recovery from the operation, he had periodic convulsive asthmatic attacks, which directly contributed to his death.

Born in Fairmont, Minnesota, December 13, 1869, his early education was received in the local schools. He was one of the few matriculants in the course in veterinary medicine that was once offered by the University of Minnesota. Later he transferred to the Chicago Veterinary College and was graduated in 1893. He first located at Jackson, Minn., but remained there only a short time. He removed to Worthington and remained there the rest of his life. He served as mayor of Worthington, as president of the City Council, as chairman of the Board of Health, and as a member of the Board of Education, at various times between 1904 and his death.

Dr. Gould joined the A. V. M. A. in 1899 and was elected first vice-president in 1919. At the 1924 meeting, he was elected second vice-president. He joined the Minnesota State Veterinary Medical Association in 1897, the year it was organized. In 1901 he was elected to the presidency and continued his interest in the organization until his demise. In 1919 Dr. Gould was appointed a member of the Minnesota State Live Stock Sanitary Board and served in this office until 1926. He was actively identified with Masonic and Kiwanis work in his community.

Surviving Dr. Gould are his widow (née Ethel Oakes) and a brother, Colonel John H. Gould (retired), of Des Moines, Iowa.

In the death of Dr. Gould, Minnesota veterinarians lose one of their most able and loyal colleagues. In addition to being an excellent internist and surgeon, Dr. Gould always was active in championing constructive veterinary legislation and activities. Dr. Gould was a man who had definite opinions, to which he did not hesitate to give expression. He was sincere and he was a man who could blend into his sincerity a kindly feeling toward his fellowmen.

H. C. H. K.

JAMES H. WOODSIDE

Dr. James H. Woodside, of Newberg, Oregon, commited suicide by shooting, January 13, 1932. No reason is known for Dr. Woodside's act. He was a graduate of Cornell University, class of 1909, and at various times had practiced at Conklin and Groton, N. Y.; Redmond, Wash., and Newberg, Ore.

Dr. Woodside joined the A. V. M. A. in 1913. He was a member of the Washington and Oregon State Veterinary Medical associations.

SEYMOUR J. WALKLEY

Dr. S. J. Walkley, of Milwaukee, Wis., died suddenly at his home, February 26, 1932. Death is reported as having been due to heart disease.

Born at Equality, Alabama, June 7, 1880, Dr. Walkley attended Highland Home College, from 1891 to 1893; Alabama Military Institute, from 1893 to 1895, and Marion Military Institute from 1895 to 1896. He also pursued various business courses as well as a course in law at Marquette University, Milwaukee, Wis. He entered the service of the U. S. Bureau of Animal Industry on April 25, 1904. While holding his position in the Bureau, Dr. Walkley completed his veterinary course at the McKillip Veterinary College, receiving the degree M. D. C., in 1907. He was appointed Veterinary Inspector, May 20, 1907, and continued to serve in that capacity until June 11, 1923, when he resigned to engage in the practice of law. He reëntered U. S. Bureau of Animal Industry service on December 1, 1925, and continued in the service at Milwaukee until the date of his death.

In 1913, Dr. Walkley was elected secretary of the National Association of B. A. I. Veterinarians and during the years 1914-16 he was the legislative representation of the organization at Washington. He joined the A. V. M. A. in 1909 and served as a member of the Committee on Legislation from 1916 until 1923. He was a member of the American Association for Labor Legislation and the National Association for the Study and Prevention of Tuberculosis. He had many Masonic affiliations.

CHARLES COOPER BROWN

Dr. C. C. Brown, Sr., of Memphis, Tennessee, died at his home, February 28, 1932, at the age of 63. He had retired from active practice a year ago, on account of ill health.

Born at Hockville, Indiana, Dr. Brown secured his veterinary education at the Chicago Veterinary College. Following his graduation in 1894, he entered practice at Waco, Texas. He removed to Memphis, Tenn., in 1902, and remained there until his death. At various times he was City Veterinarian and Deputy State Veterinarian. He was one of the organizers of the Dixie Veterinary Medical Association, which ceased to function several years ago. He was a member of De Soto Masonic Lodge and active in Boy Scout work.

Dr. Brown is survived by his widow (née Jennie Bolton), one son, one brother and one sister.

E. H. KINNETT

Dr. E. H. Kinnett, of Bushnell, Ill., died at his home, February 29, 1932. He was a graduate of the Chicago Veterinary College, class of 1890, and practiced at Bushnell for about 35 years.

WILLIAM CHESTER GRAHAM

Dr. W. C. Graham, of Valparaiso, Indiana, died at the Christian Hospital, March 1, 1932, after a brief illness due to pneumonia.

Born at Decatur, Illinois, November 6, 1896, Dr. Graham attended Canton (Ill.) High School and the Kansas City Veterinary College. Following his graduation in 1918, he located at Lewistown, Ill., where he remained until a few years ago, when he removed to Valparaiso. During the war he was a member of Veterinary Company No. 1 at Camp Greenleaf, Ga.

Surviving Dr. Graham are his widow (née Bernice Owens), four children, his parents, three brothers and one sister.

EDWARD P. SCHAFFTER

Dr. E. P. Schaffter, of Detroit, Mich., died at Harper Hospital, March 4, 1932, after a brief illness.

Born at Mount Eaton, Ohio, March 10, 1867, Dr. Schaffter attended local grade and high schools before entering the Ontario Veterinary College. Following his graduation in 1888, he entered general practice in Ohio. On July 15, 1896, he was appointed assistant inspector in the U. S. Bureau of Animal Industry and assigned to meat inspection at Kansas City. The following year he was transferred to Cleveland, Ohio, later being placed in charge of the station.

Effective October 1, 1909, Dr. Schaffter was placed in charge of inspection work for the Bureau of Animal Industry at Liverpool, England, and, while on this permanent assignment, he represented the United States at the Second International Congress for the Repression of Frauds in Foods, Chemical Products and Drugs, held in Paris, October 17 to 24, 1909. In 1912, he represented the Department of Agriculture at the National Horse Show, held at Brussels, Belgium, on which occasion he was decorated by King Albert with the Order of Leopold II. Dr. Schaffter returned to the United States in September, 1912, and was placed in charge of meat inspection at Detroit, Mich., serving in that capacity until his transfer to Los Angeles, Calif., became effective on January 1, 1928. He was retired from active service August 31, 1930, following which retirement he returned to Detroit.

Dr. Schaffter joined the A. V. M. A. in 1896, and at his death enjoyed the distinction of having been a member of the A. V. M. A. longer than any other B. A. I. veterinarian, active or retired, outside of Washington. Dr. Schaffter was extremely proud of this record. While stationed in Detroit, he was a frequent visitor at the A. V. M. A. office. He always paid his dues in person and frequently expressed the opinion that any veterinarian who did not belong to the A. V. M. A. was derelict in his duty. Dr. Schaffter was very fond of reading veterinary literature and often borrowed books and other publications from the A. V. M. A. library. A short time before his death he had called at the office to get a fresh supply of reading matter and went away happily, with a good-sized bundle of French veterinary periodicals under one arm.

A firm believer in organized veterinary medicine, Dr. Schaffter was a regular attendant at meetings of veterinary associations held in cities where he was located. He rarely missed a meeting of the Southeastern Michigan Veterinary Medical Association, from the time of its organization in 1917, until he left Detroit for California, in 1928. The Association marked the occasion with a banquet in his honor. He served as president of the organization for the year 1918-1919. He was a 32nd degree Mason.

Dr. Schaffter is survived by his widow (née Minnie Mesner), two sons and one daughter.

WILLIAM A. McEWAN

Dr. William A. McEwan, of Elgin, Illinois, died at Saint Joseph's Hospital, March 7, 1932. Death was attributed to injuries that he had received in an altercation, six weeks previously.

Born in East Burlington, Ill., July 30, 1885, Dr. McEwan attended local schools and the Chicago Veterinary College. He was graduated in 1909 and located at Hampshire, Ill., where he practiced until 1926, when he removed to Elgin. He is survived by his widow (née Florence Hurd), one son, one daughter, four brothers and three sisters. Drs. H. L. McEwan (Chi. '08), of Elburn, Ill., and J. L. McEwan (Chi. '12), of Frankfort, Ill., are brothers of the deceased.

F. E. ALLEN

Dr. F. E. Allen died at his home in West Palm Beach, Florida, March 12, 1932, following a brief illness. Born April 17, 1884, at Longmont, Colo., he removed to Marengo, Ill., as a boy. He studied veterinary medicine at the McKillip Veterinary College and, following his graduation in 1907, located at Belvidere, Ill., where he practiced for quite a number of years, before going to Florida. He is survived by his widow, one daughter and two brothers.

Our sympathy goes out to Dr. E. F. Johnston, of Carp, Ontario, in the death of his wife, Mrs. Elsie Marissa Johnston, on October 25, 1931, at the Ottawa Civic Hospital, Ottawa, Canada; and to Dr. G. G. Ratz, of Red Bud, Illinois, in the death of his wife, January 22, 1932.

PERSONALS

MARRIAGES

Dr. Walter C. Ferrall (O. S. U. '31) to Miss Kathryn A. Donbart, both of Columbiana, Ohio, Feb. 7, 1932.

BIRTHS

To Dr. and Mrs. P. V. Neuzil, of Blairstown, Iowa, a son, Gene Vincent, February 11, 1932.

To Dr. and Mrs. R. A. Crider, of Elgin, Iowa, a daughter, Barbara Rae, March 3, 1932.

To Dr. and Mrs. M. L. Spear, of Oelwein, Iowa, a daughter, Virginia Lynne, March 8, 1932.

PERSONALS

Dr. P. D. Marvin (Corn. '31) is practicing at Machias, N. Y.

Dr. D. M. Overacker (Corn. '31) has entered practice at Antwerp, N. Y.

Dr. Lloyd D. Jones (Iowa '31) has removed from Rochelle, Ill., to Hampshire, Ill.

Dr. T. W. Goers (Corn. '31) is manager of the certified milk herd at the Stoneleigh Farm, Carmel, N. Y.

Dr. J. C. Glenn (Chi. '07), of Norway, Iowa, is recovering from the effects of a very severe kick by a horse.

Dr. W. C. Sprinkle (T. H. '11), formerly of Martin, Tenn., located at Palmyra, Ill., about the middle of February.

Dr. I. M. Moulthrop (Corn. '31) is engaged in poultry disease work at the Maryland Agricultural College, College Park.

Dr. J. William Watt (Ont. '23) reports a change of address from Bay Shore, N. Y., to 409 Savin Ave., West Haven, Conn.

Dr. B. C. McClintock (Chi. '94), formerly of Los Angeles, Calif., has located at Vicksburg, Mich., for general practice.

Dr. E. H. Riley (Geo. Wash. '11), formerly of Racine, Wis., is now located at the Fidelity Laboratories, Inc., Oklahoma City, Okla.

Dr. L. A. Stueland (Iowa '27), who has been with Drs. Case and Plant, of Akron, Ohio, for several years, has located at Lake Mills, Iowa.

Dr. Wm. S. Miller (U. P. '26) has announced the location of his new office at Second Avenue and Kings Highway, Haddon Heights, New Jersey.

Dr. E. E. Slatter (O. S. U. '30), of Fremont, Ohio, has accepted a position in the Division of Animal Pathology and Hygiene, at the University of Illinois, Urbana, Ill.

Dr. D. J. Bynacker (U. S. C. V. S. '13) has been appointed instructor in veterinary science at the Mississippi State College, succeeding Dr. C. E. O'Neal (K. S. C. '16).

Dr. M. L. Boevers (Iowa '24), who has been at Iowa State College, the past year, recently gave a new address as follows: 1332 San Pablo Ave., El Cerrito, Calif.

Dr. E. Ziegenbusch (Cin. '12), of Delphos, Ohio, spent the month of February in the South, accompanied by Mrs. Ziegenbusch, according to a postal card mailed from Tampa, Fla.

Dr. R. R. Dykstra (Iowa '05) addressed the annual meeting of the Kansas Home Economics Association, held at Salina, March 11-12, on the topic, "Milk and Disease Transmission."

Dr. R. M. Nyblett (Ont. '02), formerly of Lonesome Butte, Sask., expects to retire from the service of the Canada Health of Animals Branch, this month. He is now located in Victoria, Brit. Col.

Dr. Cass J. Kershaw (Mich. '30), of Wyandotte, Mich., has accepted a position with the Michigan Humane Society and has been placed in charge of the Society's animal shelter in Detroit.